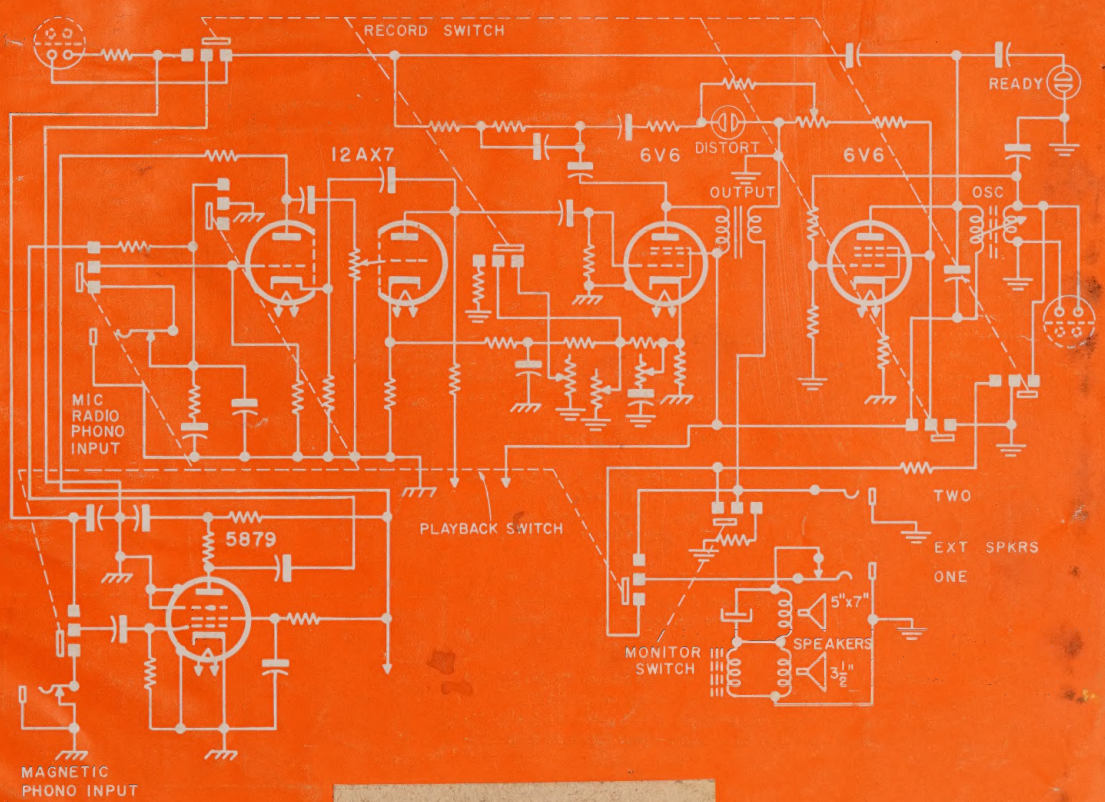
RADIO · TELEVISION · ELECTRONIC

SERVICE

VOL. 23

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

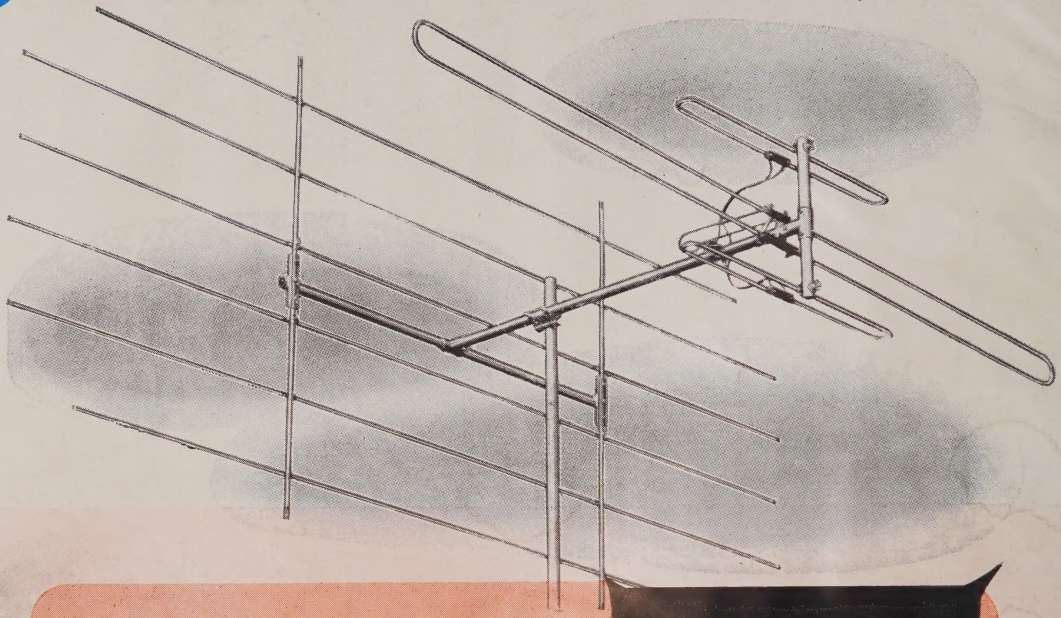
OCTOBER 1954



Four-stage tape amplifier with a low-noise pentode preamp equalizer.
[See circuit analysis, this issue]

D V DAWSON 2-56
1010 S ANDERSON
ELWOOD, IND

200 SR 2-11-54



RADIART ULTAMATIC

All-Channel TV Antenna

for the FIRST time ...the FIRST Antenna with which You Can *See the Difference*

perfectly synchronized for monochromatic and color TV

THESE QUALITIES HAVE BEEN COMBINED INTO THIS SINGLE ANTENNA — THE ULTAMATIC . . .

★ **LOW VOLTAGE STANDING WAVE RATIO** . . . the mis-match between antenna and transmission line is lower than four competitive types tested, an attribute to its broad band quality.

★ **FRONT-TO-BACK RATIO** . . . higher than multi-element, yagi-type antennas, minimizing co-channel interference.

★ **GAIN** . . . expressed in decibels, is a ratio of signal voltage developed by an antenna over that of reference folded dipoles. It is not a quality sold by the pound or achieved by the addition of meaningless elements. The curves shown accurately describe the gain of the Ultamatic. Loss of sound or picture due to erratic antenna response is eliminated.

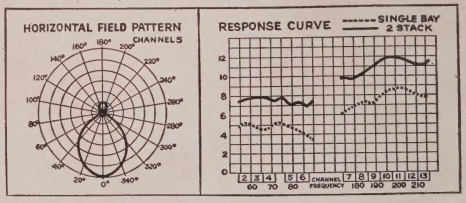
MECHANICAL FEATURES

★ Aluminum screen reflector of exclusive fold-out design, assembled in seconds with adequate stability for years of trouble-free service. Longer elements insure maximum front-to-back ratio on channels 2-6 and are more closely spaced for increased performance on channels 7-13.

★ Dipole and boom assembly are of heavy gauge, seamless tubing. Dipoles fold out and are rigidly supported and reinforced to minimize sag and sway.

★ Specifically designed mechanically by stress analysis of each unit and sub-assembly to provide a low vibrational period of all elements — your assurance of trouble-free installations.

Most Uniform Gain Response *The gain response DOES NOT VARY MORE THAN 3 D. B. ON ANY CHANNEL across the band. This quality is exceedingly important in color reception to insure adequate color synchronization without resetting.*



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CLEVELAND 13, OHIO

TV ANTENNAS ★ AUTO AERIALS ★ VIBRATORS ★ ROTORS ★ POWER SUPPLIES

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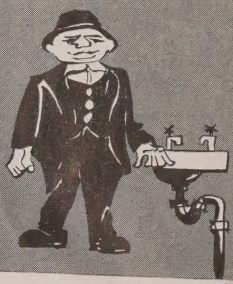
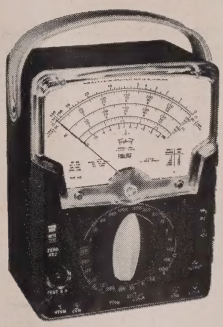
or a is 2 a ,

or a is 2 a  ,

the  is 2 U!

MODEL 631 VOM-VTVM $59.50 NET

Because—it's TWO-in-One for the price of one! It's a VTVM—It's a VOM with just the flip of a switch!

This one combination instrument will be the serviceman's most frequently used piece of test equipment. No need to invest in two separate testers when one will do his work at half the price—**$59.50** net.

Flip the switch, it's a **V T V M** (completely portable; battery operated—VTVM accuracy not subject to line voltage fluctuations — Input Impedance of 11 megohms).

Flip the switch and it's a **V O M** (with the sensitivity to match readings in all the service manuals—20,000 ohms per volt DC, 5,000 ohms per volt AC).

Ranges entirely adequate for servicing needs. All 34 ranges selected by one knob control—minimizes incorrect settings and burnouts. Unbreakable clear plastic meter case front floods light on long, readable scales.

Triplett Model 631 is sold by leading distributors everywhere.

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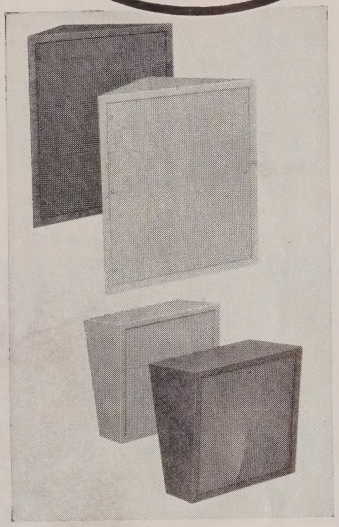
TRIPLETT ELECTRICAL INSTRUMENT CO., Bluffton, Ohio

FIRST NEW BAFFLES IN ALMOST A GENERATION



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Wall Baffles	**Corner Baffles (Base Reflex)**
4/5" $2.37	8" $6.75
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10" 4.02	* Dealer Net. Slightly higher far West.
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Craftsmanship in Cabinets

Vol. 23, No. 10

RADIO · TELEVISION · ELECTRONIC
SERVICE

October, 1954

LEWIS WINNER
Editor

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Assistant Editors

Including SERVICE—*A Monthly Digest of Radio and Allied Maintenance;* RADIO MERCHANDISING and TELEVISION MERCHANDISING. Registered U. S. Patent Office.

Association News 12

A Report on Phono Needles (Part II: Needle Design . . . Types). By Wyn Martin 38

Color-TV Sync Demodulator Circuits. By Robert G. Middleton 18

Color TV Latest in Audio 43

Ser-Cuits (Four-Stage Hi-Fi Tape Amplifier; Cover). By M. W. Percy 28

Service Engineering (Packaged Mobile Audio System). By Robert M. Wood 24

Service . . . The National Scene 35

Servicing Helps (TV-Chassis Power-Supply Conversion With Selenium Rectifiers). By T. L. Gilford 26

Ten Years Ago 13

The AAC Audio Forum (Part II):
Modern Hi-Fi Amp Design Concepts. By Robert Newcomb 41
The Equalizer-Preamp. By V. H. Pomper 42

The Value of TV Chassis Test Points. By J. C. Geist 16

Color TV Tube News (Three-Gun 21-Inch Tricolor Picture Tube). By E. A. Teverson 25

UHF/VHF TV Antenna Digest (Evolution of Single-Lobe Pattern VHF Antenna). By Ralph G. Peters 20

Views and News. By Lewis Winner 15

CIRCUITS

Color TV I Synchronous Demodulator Circuit 19
G.E. 21T7 and 21T8 Top-of-Chassis Test Points 17
Emerson 760 Video and Horizontal Oscillator Test Points 17
RCA KRK29A/27 VHF/UHF Tuner With Test Points 16
Selenium Rectifier Full-Wave Voltage Doubler 26
Selenium Rectifier Half-Wave Voltage Doubler 26
VHF Tuner With Test Point 16
V-M Model 700 Tape-O-Matic Tape Amplifier (Cover) 28
Z and W Model 31-A Mobile Audio Amplifier 24

COVER

Four-Stage Hi-Fi Tape Amplifier (V-M Model 700 Tape-O-Matic) 28

Index to Advertisers 63

Manufacturers

Catalogs and Bulletins 8
Instruments 61
Jots and Flashes 63
News 57
New Parts . . . Tools 59
On Book Row 9
Personnel 32
Rep Talk 58
TV Parts . . . Antennas . . . Accessories 62

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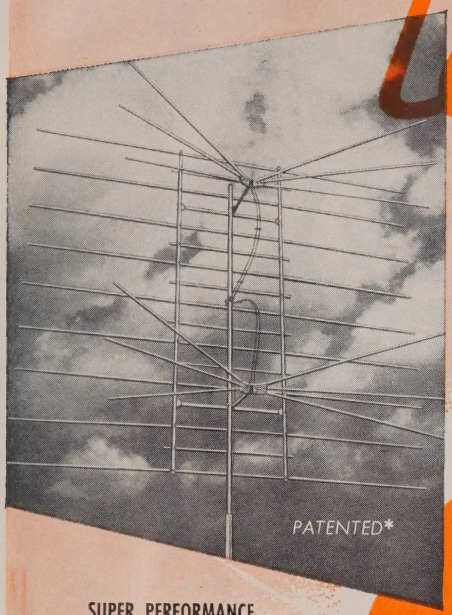

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— designed to obsolete all existing TV arrays, provides maximum gain, maximum F/B ratio, minimum spurious lobes, no phase shift — best for B&W or Color TV

SUPER PERFORMANCE ON VHF — EXCELLENT PERFORMANCE ON UHF

"CONICAL-V-BEAM" DIPOLES FOR BEST AND MOST UNIFORM MATCH TO 300 OR 200 OHM LINE ACROSS ENTIRE BAND

FULLY PRE-ASSEMBLED — INSTALLS QUICKLY AND PERMANENTLY

NO PHASING (PHASE SHIFT) TRANSFORMERS ATTACH 300 OHM LINE OR 200 OHM LOW LOSS LINE

ALL ALUMINUM CONSTRUCTION LIGHTWEIGHT — DURABLE NO RIVETS TO WORK LOOSE AND BECOME NOISY!

The best S/W/R, S/N/R and H-E plane pattern TV Array ever devised. Utilizes the Patented "Conical-V-Beam" theory to perfection. "Conical-V-Beam" dipoles provide true broad-band characteristics with maximum gain and signal to noise ratio with NO PHASE SHIFT. New transmission line and spline back provide the perfect pattern on all channels. If you've tried the rest — Now! Try the best!

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Model 201 (Single Bay)	$26.50
Model 202 (2 Bays Stacked)	$57.00
Model 204 (4 Bays Stacked)	$124.00

AMERICA'S OUTSTANDING TELEVISION BEAM

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ASBURY PARK 4 NEW JERSEY

*"Conical-V-Beams" are produced under U. S. Patent No. 23,346, Canadian Patent No. 500,436 and British Patent No. 691,485 — other patents pending. Sold only through authorized distributors.

new!

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GUARANTEED TO OUTPERFORM

ANY equivalent type antenna or

YOUR MONEY and LABOR COSTS BACK!

Enough words have been written about TV antenna performance. *Now, see the facts for yourself!* Compare any of the new PHILCO Super Performance TV Antennas with any equivalent type on the market. If the new PHILCO does not give you the finest picture possible, your money back for the antenna *plus* your labor costs up to $10.00. Here at last is *real* guaranteed performance! PHILCO TV Antennas provide gains up to 15 db in some models . . . strong signal pickup . . . high front to back ratio. Powerful Conical . . . all-aluminum VHF Yagis, engineered for quick rigging . . . light weight. Stacked versions provide top-quality fringe area reception. Six UHF Yagis cover the entire UHF spectrum.

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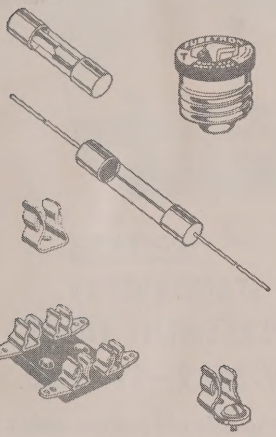

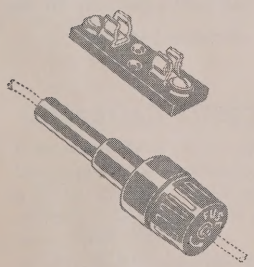

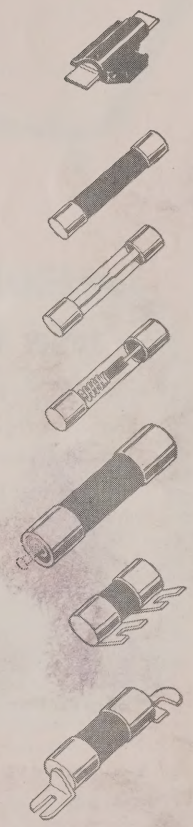

Constant research and engineering over the past 39 years have resulted in a most complete line of BUSS fuses: dual-element (slow blowing), renewable and one time types . . . in any size from 1/500 amperes up — plus a companion line of fuse clips, blocks and holders.

To make sure that BUSS fuses meet the highest standards of dependability . . . every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device that automatically rejects faulty fuses.

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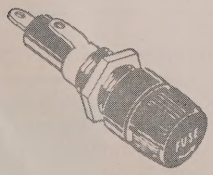
BUSS fuses have ready customer acceptance. The millions and millions of fuse installations for home, farm and industry have firmly established the dependability and unquestioned high quality of BUSS fuses. And BUSS fuses stay sold because your customers stay satisfied.

Makers of a complete line of fuses for home, farm, commercial, electronic and industrial use.



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TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
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Please send me bulletin SFB containing facts on BUSS small dimension fuses and fuse holders.

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Company.....

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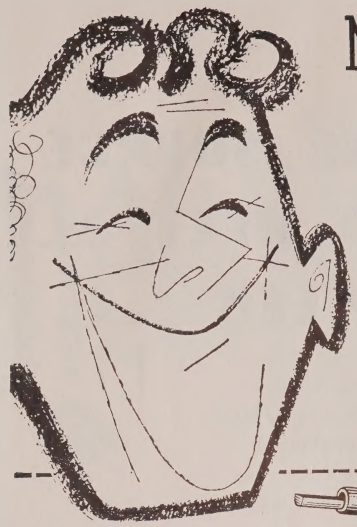
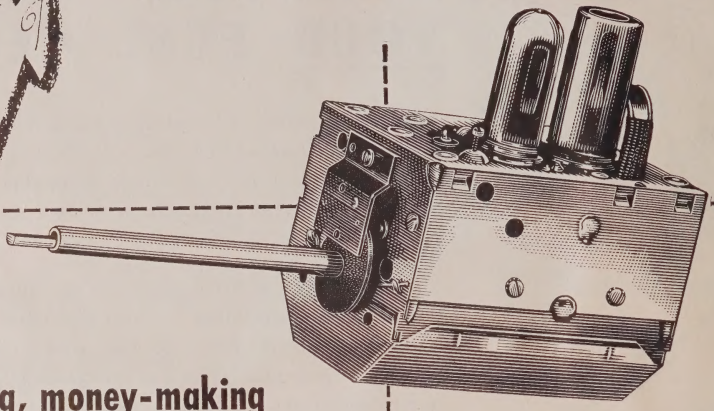


NOW! Any TV serviceman may ADD $60, $100 OR MORE A WEEK TO GROSS PROFITS!



Share in the big, money-making tuner replacement market!

Hundreds of TV set owners in your community will welcome the sharper, stronger pictures afforded by newer, more powerful Standard cascode and pentode tuners. And a completely new Standard replacement tuner often costs your customer *less* than the parts and labor required for a major repair to the original tuner.

Approved Standard Tuners Install Faster, Easier!

Standard replacement tuners have shafts and leads easily cut to fit any set. In most jobs the tuner mounts into the space occupied by the original tuner with no alteration of the cabinet front.

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Set owners demand adaptability to UHF—and get it when you install Standard replacement tuners. Standard UHF conversion strips are priced to sell, permit easy, perfect tuning, and require no outside cabinet, adjustments, wires or extra parts of any sort.

Sell ***Approved***

STANDARD TV REPLACEMENT TUNERS TV-2232—TV-1532

Super cascode and pentode models designed and built *especially* for the replacement market

STOP COSTLY CALLBACKS!

Install only APPROVED Standard TV replacement tuners. Non-approved tuners often *can not* be adapted to a particular set with satisfactory results. Each approved Standard tuner comes individually boxed, complete with circuit diagrams and installation data. Accept no substitutes!

Standard

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Get set for bigger profits with Standard Coil's line of TV replacement tuners. Call your jobber today or write Standard Coil Products Co., Inc., 2085 North Hawthorne Avenue, Melrose Park, Illinois.

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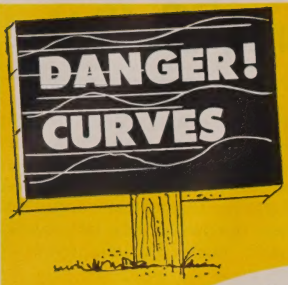

Don't let any Antenna Manufacturer pitch curves to you!

new WINEGARD INTERCEPTOR

with Exclusive Electro-Lens* Focusing means . . .

Don't be misled by any manufacturer's "homemade" charts on antenna performance. We can show you how to plot curves that will "prove" that a busted steel guitar on an 8-ft. flagpole outperforms any antenna you can name—even our own superb *Winegard* INTERCEPTOR.

No—all that counts is, PERFORMANCE IN ACTUAL USE. Therefore, DO THIS: Use a *single* INTERCEPTOR on your next installation where you'd ordinarily stack two bays. See if *one* INTERCEPTOR doesn't give better results than any stacked installation you have made nearby. Once in a blue moon, a second bay is necessary even with our INTERCEPTOR. But rarely. So we say to you, "Why use *two* when ONE will do?"

Order an INTERCEPTOR today. Let it tell its own story in the only place it counts—on one of your own installations. If it doesn't far surpass any other antenna you've ever used, fire it back to us! We'll return your money—and we'll still be friends! So . . . order NOW!

A FAR BETTER PICTURE OR YOUR MONEY BACK!

Antenna No.	Winegard Trade Name	List Price
L-4	INTERCEPTOR	$24.95 a bay
L-5	PIXIE	$14.95 a bay

Shipped, one L-4 to a carton (stacking bars available)
Shipped, two L-5's to a carton with stacking bars.

WINEGARD PIXIE
A quality all VHF channel antenna for top performance at a low price.

*Patent Pending

THE INTERCEPTOR gives the clearest, sharpest pictures obtainable . . . not just on one or two channels . . . but on all *12* VHF channels.

See your jobber now or write us for complete information.

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I'D RATHER USE TUNG-SOL TUBES

There's every reason why servicemen feel this way. Tubes they need they can get. Quality is always uniform—always up to set manufacturers' specs. Callbacks are rare. It's more profitable for servicemen to use Tung-Sol Tubes.

TUNG-SOL®
dependable
PICTURE TUBES

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TUNG-SOL ELECTRIC INC., Newark 4, N. J.
Sales Offices: Atlanta, Chicago, Columbus, Culver City (Los Angeles), Dallas, Denver, Detroit, Newark, Seattle.

Catalogs and Bulletins

ALLIED RADIO CORP., 100 N. Western Ave., Chicago 80, Ill., has published a 308-page catalog, *140,* describing hi-fi components, including 31 complete hi-fi systems; TV chassis, boosters, rotators and *uhf* converters; professional and home recording equipment; *pa* amplifiers and systems; industrial *vhf* radio and radio-telephone equipment; and kits, books, tools and hardware, plus other radio, TV and industrial electronic items.

* * *

CBS-HYTRON, Danvers, Mass., has released the seventh edition of the *CBS-Hytron Reference Guide for Miniature Electron Tubes.* Guide details all miniature tubes regardless of make, and includes 329 types, 79 of which are new, plus 134 basing diagrams. Larger prototypes are also listed.

* * *

SYLVANIA ELECTRIC PRODUCTS INC., 1740 Broadway, New York 19, N. Y., has issued a brochure reviewing the manufacture, properties, and uses of Tungsten. Featured is a colorful flow-chart which shows how tungsten is manufactured and quality-controlled from ore to finished products.

* * *

RCA TUBE DIVISION, Commercial Engineering, Harrison, N. J., has prepared a 36-page *Service Parts Directory, (SP-1021),* containing basic service and parts-replacement data for all '52 RCA TV receivers. Provides diagrams, parts lists, and top and bottom chassis views for 27 different models. Also includes a cross-reference which identifies by model name and number RCA receivers produced between '46 and '52, and indicates previous issued directories in which they are described. Priced at $.50.

* * *

SHURE BROTHERS, INC., 225 W. Huron St., Chicago 10, Ill., has published catalog *55,* describing microphones, microphone accessories, magnetic tape and wire recording heads, crystal and ceramic pickup cartridges, crystal phono pickups, and needles. Catalog features replacement charts for pickup cartridges and magnetic recording heads.

* * *

ROHN MANUFACTURING CO., 116 Limestone, Bellevue, Peoria, Ill., has released a catalog sheet on their No. 6 tower and packaged tower, and a folder on towers and accessories.

* * *

MERIT COIL AND TRANSFORMER CO., 4427 N. Clark St., Chicago 40, Ill., has issued replacement guide *407,* listing replacements for transformers, yokes, flybacks, and *if* and *rf* transformers, in about 7000 TV models and chassis.

* * *

ANTENNA SPECIALISTS CO., 12415 Euclid Ave., Cleveland 6, Ohio, has prepared a 6-page catalog, covering mobile communication and ground plane antennas. Also detailed are universal swivel bases, shock-mounting springs, rods, and rooftop auto antennas for 144-174 and 450-470 mc.

* * *

CHICAGO STANDARD TRANSFORMER CORP., Addison and Elston, Chicago 18, Ill., has released 8-page bulletin *(469) TV Replacement Transformer Popularity Tables.* Bulletin lists the number of TV models that use each Stancor replacement transformer, and includes separate tables for each of 100 major set manufacturers.

* * *

DE-LUX NEON MANUFACTURING CO., 1007 NW 36th St., Oklahoma City 3, Okla., has published a 12-page catalog *(54),* detailing portable cranes and ladders for TV antenna service.

On Book Row

RADIO'S MASTER—1954-55—19TH EDITION: A husky electronic part and equipment catalog with more than 85,000 items and over 9,000 illustrations, with full descriptions, specifications and prices. Includes a detailed index to help the user quickly locate the products of 355 manufacturers.—*1440 pages, hard bound covers, priced at about $1.95; United Catalog Publishers, Inc., 110 Lafayette St., New York 13, N. Y.*

* * *

RCA RECEIVING TUBE MANUAL, RC-17: An invaluable manual with data on more than 500 RCA receiving and picture tubes, including types for black-and-white and color TV. Features basic tube theory and application information, as well as a description of cathode-drive circuits and effects of contact potential on bias supplies. In section on interpretation of tube data, plate-characteristic curves for several half-wave vacuum rectifiers have been added, as well as a new rating curve for determining maximum permissible screen input for voltage amplifiers. Picture tube chart permits comparison of the features of individual types; basing diagrams and spectral-energy emission characteristics of phosphors used in the picture tubes are also provided. Section on circuits now includes circuits for hi-fi audio amps, including a low-distortion input amp stage, two-stage input amp using cathode-follower (low-impedance) output, a bass and treble tone-control amp stage, and a complete 10-watt hi-fi amp.—*300 pages, 8⅜" x 5⅜", paper bound, priced at $.60; Commercial Engineering, RCA Tube Division, RCA, Harrison, N. J.*

* * *

OBTAINING AND INTERPRETING TEST 'SCOPE TRACES . . . BY JOHN F. RIDER. A unique book, containing more than 1,000 waveforms taken off test 'scope screen. Explains make-up of waveforms of all kinds and shows numerous examples of each type of distortion; also discusses the reasons for the distortion seen in the waveform. Book then correlates waveform distortion with the condition that can cause it.—*192 pages, 5½" x 8½", paper bound, priced at $2.40; John F. Rider, Publisher, Inc., 480 Canal St., New York 13, N. Y.*

* * *

RESIDENTIAL WIRING HANDBOOK: A useful manual (revised edition) featuring standards for home wiring systems, brought into line with current and anticipated future usage of electricity in the average home. A one-story house plan is now included in the floor plans. Explanatory material offers some discussion of the growth of the use of electricity, as well as its practical applications by architects and engineers, builders, electrical contractors, new home buyers, and those engaged in modernizing older homes.—*32 pages; Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.*

* * *

HOW TO SERVICE TAPE RECORDERS . . . BY C. A. TUTHILL: A competent analysis of tape recorders, both professional and home models. Author describes magnetic recording principles and applications, tape recording mechanisms, electronic requirements of recorders and their accessories, with practical mechanical and electronic information, maintenance and repair of popular tape-recording machines, and step-by-step procedures for systematic troubleshooting and repair of tape recorders.—*160 pages, 5½" x 8½", paper bound, priced at $2.90; John F. Rider, Publisher, Inc.*

I'D RATHER YOU WOULD

Customer confidence in local servicemen is due in large measure to the dependability of the products they use. Tung-Sol maintains quality standards that build up the local serviceman in his community.

TUNG-SOL®
dependable
TUBES—DIAL LAMPS

TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

TUNG-SOL 50 YEARS ACHIEVEMENT

JFD ADVANCED ENGINEERING CREATES A RADICALLY NEW ANTENNA!

INCREDIBLE

is the only way to describe the new JFD

JET-HELIX

a radical new flat plane helical concept for VHF-UHF

it's "the RAINBOW antenna"

APPROVED FOR COLOR TV

INCREDIBLE FEATURES!

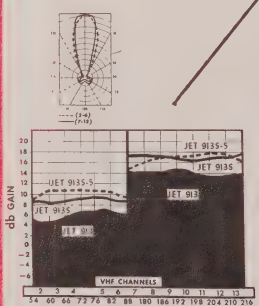
- delivers highest gain!
- outstanding front to back ratio!
- sharpest picture clarity!
- greatest fidelity color reception!
- finest snow-free, trouble-free performance!

INCREDIBLE FACTS!

IT ALL ADDS UP TO A NEW HIGH IN S/N RATING

S/N FIGURE OF MERIT * JFD JET-HELIX—57.85%		
ANTENNA A	ANTENNA B	ANTENNA C
43.15%	31.85%	38.5%

*The S/N Figure of Merit sums up the major individual characteristics of an antenna in one concise value. Write for S/N Figure of Merit engineering folder No. 299 for complete details.



THE JET-HELIX IS BETTER BY AN AVERAGE OF 44.5%

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- Only the Jet-Helix has been exhaustively pre-tested in the field by JFD engineers!
- Only the JFD Jet-Helix comes to you backed by the greatest consumer advertising support in antenna history—literally pre-selling the Jet-Helix for you!
- Yes, compare its Alcoa Aluminum construction, compare its pre-assembled convenience—compare the JFD Jet-Helix by any standards known—and you *must* agree—here is the New Star of Antennas—the JFD Jet-Helix!

THE JET-HELIX IS THE *ONE* ANTENNA THAT OUTPERFORMS ALL OTHERS IN FRINGE AREAS ON BOTH VHF—UHF

MODEL	BAYS	LIST
JET 913	SINGLE	$25.50
JET 913 S	STACKED	$52.50
JET 913 S-5	HALF WAVE STACKED	$55.00

DO NOT CONFUSE WITH OTHER SIMILAR ARRAYS! THIS ANTENNA IS RADICALLY NEW!

JFD Electronics

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15 MOORE STREET NEW YORK CITY

WAR DECLARED ON DEALER CALL-BACKS!

NEW TUBE TYPES FROM SYLVANIA SPEARHEAD ATTACK!

The most important step in a concentrated campaign to eliminate dealer call-backs has been taken by Sylvania with the release of a group of new tube types. Sylvania's new 5U4GB leads the group.

The 5U4GB attacks the call-back enemy on many different fronts:

1. The tube has been re-designed. Now, plates are longer and heavier with twin wings for better heat dissipation, Sylvania's 5U4GB carries increased ratings of 275 ma at 44 volts drop with 1.0 amp peak plate current.
2. Wafer Stem Construction—originally developed by Sylvania for the lock-in tube—has been adapted to the 5U4GB. The wafer stem eliminates electrolysis, provides stronger mount construction, permits better spacing.
3. A new T-12 bulb provides greater heat dissipation, gives added strength, more rigidity because of its straight construction.
4. Bottom mica has been added to make the tube stronger, improve filament alignment and eliminate arcing.

Other Sylvania types are vastly improved, too! All have Sylvania's famous wafer stem construction, plus these additional design features:

- Better Lead Spacing
- Stronger Mount Supports
- Stronger Micas
- Firmer Filament and Plates
- Greater Protection Against Shock and Vibration
- Better Heat Dissipation
- Low Glass Electrolysis
- Fewer Burnouts
- Stronger, More Rugged Overall Construction

NO MINOR SKIRMISH

The Sylvania war on dealer call-backs is not a minor skirmish. It will continue until dealer call-backs on these and other receiving tube types are completely eliminated. The dealer's biggest profit-robbing enemy can look forward only to an incessant, continuing effort on the part of Sylvania to make his existence a thing of the past. These quality tubes are now at your Sylvania distributor's.

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SYLVANIA

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LIGHTING · RADIO · ELECTRONICS · TELEVISION

This new tube carton identifies Sylvania's new high quality, improved receiving tubes. It's assurance to dealers everywhere that inside is one of the finest receiving tubes made—unsurpassed for quality and performance. For further information write to Dept. 4R-4010 at Sylvania.

5 NEW
TRIAD *CORRECT REPLACEMENT
FLYBACKS

These new flybacks are mechanically correct and electrically correct ruggedized versions of manufacturer's items — precisely engineered by TRIAD for specific makes and models — to give exceptionally high performance and long, trouble-free service.

D-40 List Price $10.25 — Correct replacement for Admiral #79C30-2, 79C30-4, 79C38-1, 79D38-1.

D-41 List Price $10.25 Correct replacement for Admiral #79C30-1 and 79C30-3.

D-42 List Price $10.25 Correct replacement for Admiral #79D41-1, 79D41-2, Sheraton EL-112A, EL-119, EL-119B and others.

D-43 List Price $10.25 Correct replacement for Emerson #738067, 738068, 738069, 738073, 738074, 738075, 738082, 738083, 738085, 738086.

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Associations

NATESA

FRANK MOCH was reelected president of the National Alliance of Television and Electronic Service Association at a special meeting during the fifth annual convention of the group at the Hotel Morrison in Chicago. Other NATESA officers now include: *Bertram Lewis,* treasurer; *Ray Neiswonger,* secretary-general; *Ferdinand Lynn, Fred Colton, Vincent Lutz,* and *Horace Collins,* vice presidents of the eastern, east-central, west-central and western divisions, respectively; *William Briza,* secretary, west central division; *Charles Nelson Burns,* east-central secretary; and *Edward Failing,* secretary, western division.

The convention attracted delegates from California to Massachusetts, and South America and Canada.

A number of executive meetings were held to discuss *uhf,* distribution and other industry problems. In one motion, NATESA asked for congressional reappraisal of *uhf,* suggesting elimination of the upper portion of the ultrahigh band, where it was claimed too many transmission-receiving problems obtain.

In another move, NATESA suggested that the U. S. Departments of Labor and Commerce study a standard job classification system which would define the various grades of Service Men and serve to evaluate applicants more effectively.

The group also reported that they will make an effort to work with a local agency in Washington to determine what Service Men can do to stop

•

SATELLITE FORUM

At uhf satellite symposium,* conducted by ye editor **in Cleveland, at the Hotel Carter, for the IRE Professional Group on Broadcast Transmission Systems, during which members of government and industry reviewed the outlook for extended service using slave stations. Left to right:** Curtis Plummer, **chief of the FCC broadcast bureau;** Jess Epstein, **member of RCA Labs;** ye ed; L. E. Rawls, **WSM-TV (Nashville, Tenn.) supervisor of research and development;** John Whitworth, **chief engineer of WJTV-TV, Jackson, Miss.**

*See *National Scene,* this issue, p. 36, for session report.

COMPLETELY SERVICE...
COLOR TV
with only two
NEW instruments!

RAINBOW GENERATOR
Model 150
Patent Pending

NEW CIRCUITS incorporated in this instrument greatly simplify the TEST and ALIGNMENT of color TV circuits. NEW LINEAR PHASE SWEEP produces the COMPLETE PHASE RESPONSE CURVE, assuring greater accuracy with faster alignment and elimination of color bar drift problems.

APPLICATIONS

• MASTER PHASE CONTROL test and alignment • CHROMA DEMODULATOR test and alignment (either I/Q or R-Y/B-Y) • QUADRATURE TRANSFORMER test and alignment • MATRIX CIRCUIT test and alignment • BURST AMPLIFIER test and alignment • PHASE DETECTOR CIRCUIT alignment for reference oscillator • REACTANCE CONTROL and REFERENCE OSCILLATOR adjustment • 3.58 MC TRAP alignment • TROUBLESHOOTING and PHASE ALIGNMENT in the home by picture patterns.

WHITE DOT GENERATOR
Model 160

THE WHITE DOT GENERATOR ENABLES COMPLETE ALIGNMENT OF ALL COLOR CONVERGENCE CIRCUITS PLUS SWEEP CIRCUIT LINEARITY AND SIZE, AS WELL AS GENERAL TROUBLESHOOTING BY SIGNAL TRACING.

APPLICATIONS

• DYNAMIC CONVERGENCE—vertical and horizontal test and adjustment • DC CONVERGENCE—test and adjustment • DEFLECTION COIL—positioning for best convergence • BEAM MAGNETS—alignment for best convergence • DYNAMIC PHASE ADJUSTMENT—vertical and horizontal • FOCUS—test and adjustment of DC and dynamic focus • TROUBLESHOOTING of all circuits affecting convergence • LINEARITY—test and adjustment of horizontal and vertical sweep linearity • TROUBLESHOOTING from antenna to picture tube by signal tracing.

WIN-TRONIX
WINSTON ELECTRONICS, INC.
Dept. 103, 4312 Main Street
Philadelphia 27, Pa.

sales to consumers over parts-jobber counters. It was said that the Washington office would work with a special NATESA committee to study the possibilities of compiling fair trade and anti-trust rules on a nationwide basis. *Ferdinand Lynn* will serve as head of the investigating committee.

The meeting also featured a number of business and technical seminars. *Russ Hansen,* contract division manager of Motorola service department, reviewing business techniques that have been found most effective in present-day operations, declared that the number of calls completed in the home today represented about 80% of a shop's business.

Doug Carpenter, JFD chief antenna engineer, described the broad-band requirements of antennas for color TV, and the need of rotators in fringe areas.

Jim Early, Sylvania Electric, reviewing color TV, pointed out that undoubtedly rectangular picture tubes will predominate in color receivers.

Discussing the servicing of printed circuits, *Frank Hadrick* of Admiral described the care required in soldering *pc* boards, and detailed the special types of tools required in effecting repairs.

Other speakers at the meeting included: *Neal Hunter,* of Sprague, who reviewed the application of capacitors; *George Mosley,* describing the finer points of antenna installation; and *John Cunningham,* who analyzed CBS-Hytron color tubes.

TEN YEARS AGO

A BRIGHT OUTLOOK for postwar era *servicing* was forecast by the service managers of Belmont Radio, Wilcox-Gay, RCA, Farnsworth, G.E., Crosley, Packard-Bell, Westinghouse and Stewart-Warner. . . . *W. L. Jones,* RCA Service Co. vice president, predicted that postwar electronic products would provide a fertile field for service personnel. . . . *I. J. Kaar,* G.E. receiver division manager, declared that TV servicing and installation would create tremendous opportunities for the Service Man. . . . *Charles A. Nichols,* Packard-Bell Co., concurred and also cited the whole field of electronic servicing as available to those who were ready with better and improved test equipment, know-how, and salesmanship. . . . *S. J. Thompson,* Belmont service manager, said the Service Man will have to study hard and be required to invest in new test equipment, and improve his business methods. . . . *W. E. McConnell,* Wilcox-Gay service manager, stressed that the service shop or department should not be considered as a necessary evil, but rather as a profitable maintenance and good-will department. . . . *H. A. Newell,* Crosley service manager, pointed out that Service Men will be required to become familiar with higher frequencies, and get away from *change-the-bad-part* workmanship.

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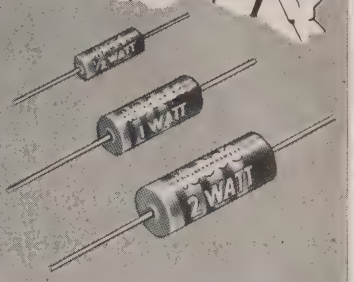
REPLACEMENTS INSURE CUSTOMER SATISFACTION

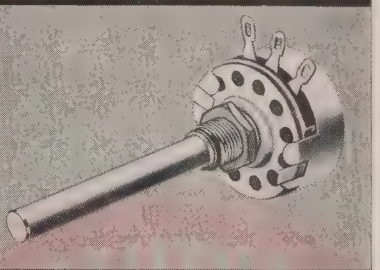
Little Devil!®
COMPOSITION RESISTORS

Tiny, yes . . . but what dependability, ruggedness, and stability! Rated at 70C rather than 40C. Completely sealed and insulated by molded plastic, they meet all MIL-R-11A requirements. Available in ½, 1 and 2-watt sizes in all RETMA values.



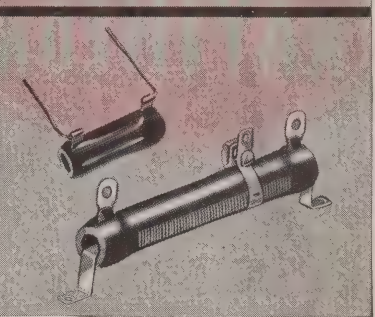
TYPE AB NOISE-FREE POTENTIOMETERS

Because the resistance material in these units is solid-molded—not sprayed or painted on—continued use has practically no effect on the resistance. Often, the noise-level *decreases* with use . . . and they give exceptionally long service. Rated at 2-watts.



BROWN DEVIL® AND DIVIDOHM® RESISTORS

BROWN DEVIL fixed resistors and DIVIDOHM adjustable resistors are favorite vitreous-enameled units! Resistance wire is welded to terminals. DIVIDOHM resistors are available in 10 to 200-watt sizes; BROWN DEVILS in 5, 10, and 20-watt sizes.



PROVIDE AN "EXTRA MARGIN OF SAFETY"

Using Ohmite replacements in your repair work is like having insurance against call-backs. The reason is, of course, the "extra margin of safety" engineered into Ohmite products. The prevention of just one call-back can save your profit on the entire job. So order a supply today, and use them on your next job.

Be Right with
OHMITE®
DEPENDABLE RESISTANCE UNITS

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OHMITE MANUFACTURING CO.
3642 Howard St., Skokie, Ill.
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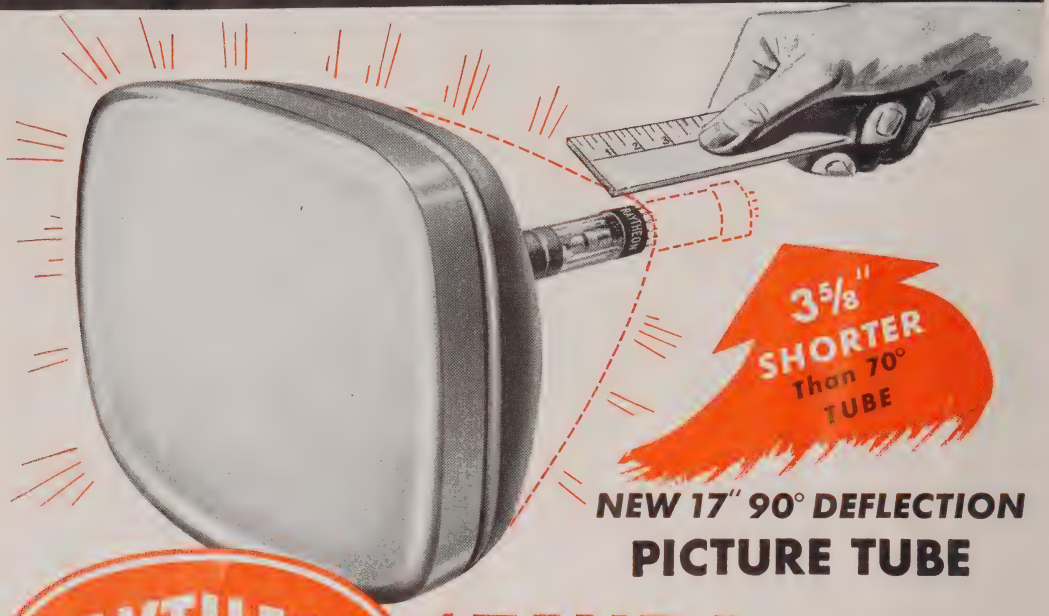
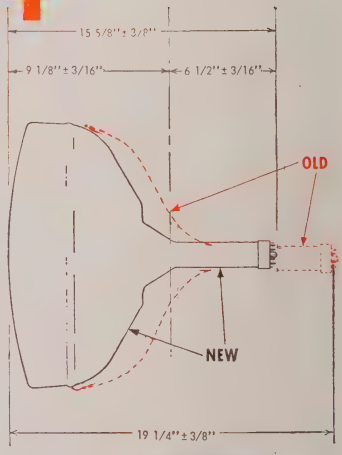
ANOTHER RAYTHEON FIRST!



NEW 17" 90° DEFLECTION PICTURE TUBE

RAYTHEON 17AVP4



Raytheon leads the way to smaller, light weight, more compact, television receivers with the amazing new 17AVP4 monochrome picture tube. It is 3⅝ inches shorter in overall length and approximately 4 pounds lighter than present 17 inch tubes. The type 17AVP4 incorporates a new 90° deflection angle bulb, a 1 inch shorter neck length and achieves maximum compactness with conventional viewing area. The 17AVP4 has electrostatic focus, magnetic deflection and features the same crisp, clean picture that makes all Raytheon Picture Tubes outstanding for quality.

This important new Raytheon tube, developed and produced at Raytheon's new modern picture tube plant at Quincy, Massachusetts is one more reason why you can standardize on Raytheon Picture Tubes with complete confidence that you are giving your customers the very latest and best.

Remember, Raytheon Picture Tubes are Right for Sight, Right for You, and always New. Buy them through your nearest Raytheon Tube Distributor.

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RAYTHEON *MAKES* ALL THESE:

RECEIVING AND PICTURE TUBES · [illegible] · SEMICONDUCTOR DIODES AND TRANSISTORS · NUCLEONIC TUBES · MICROWAVE TUBES

RADIO · TELEVISION · ELECTRONIC
SERVICE

A Challenge and a Responsibility

DESPITE ALL OF the precautionary measures that have been taken to curb TVI, the situation is still acute. A sturdy effort to minimize the problem has been made by a number of manufacturers who have altered their receiver designs, moving the *ifs* to the 40 to 46-mc region, because there are fewer transmitters radiating in this band. More set makers, it is hoped, will join the march. But, unfortunately, these noble drives cannot completely erase the annoyance, because all too often the trouble is, as noted on several occasions in SERVICE, of a varying nature created by assorted types of local electronic and mechanical devices whose radiating signals fall within the tuning range of TV *if* and even *rf* stages.

There are two basic types of TVI. One involves an undesired signal of such radiated frequency that it falls in the *rf* passband of the tuner. This might be a harmonic of some carrier fundamental not sufficiently suppressed at its own transmitter. The suppression of this carrier's harmonic at the transmission point may well be within specified limits, but because of the nature of the location, it is producing TVI. The offender may also be a neighboring band in the TV channel, so that we have a heterodyning effect in the receiver's local oscillator, producing a frequency point in the *if* amplifier's passband. In the second type we have the carrier fundamental frequency directly in the tuning range of the *if* stages. It is this type of TVI that has been found to be a major source of trouble.

To keep interfering signals from reaching the *if* amplifiers, many manufacturers have provided traps, connected at the input to the tuner. Other receivers without these traps require external attachments in the form of stubs. If the problem is an extremely involved one, high-pass filters might be necessary; these must attenuate all frequencies below 50-mc and pass all frequencies above this point. If the filter is not adequate, more attenuation might be obtained from tuned traps.

Field experiences have disclosed, however, that in many instances TVI is so strong that neither stubs, filters nor traps are helpful. Here, regardless of the attenuation and rejection of the desired signal, interference may still reach the *if* and produce herring-bone patterns on the picture tube or background voices in the speaker. In searching for a solution to this balky problem,* *service* specialists found that shifting of the *if* bandpass beyond the carrier frequency point of the TVI was the answer. This move served to place the receiver's *if* tuning range above or below the frequency of the interference and by so doing offered rejection to this signal.

There are a number of other equally complex interference projects still to be resolved. Rugged as these assignments might be, many, including a host of Service Men, have accepted them—as a challenge to their ability and ingenuity, and particularly as a responsibility towards industry to insure better viewing for all.

The Reader Is Boss

FOR NEARLY TWENTY years we have proudly displayed the *ABC* symbol, insigne of the Audit Bureau of Circulations.

Since the *ABC* is this month observing its fortieth anniversary, we would like to pause in our editorial duties to explain the significance of our membership in the bureau to our readers and advertisers.

Just as the manufacturer and merchant buy and sell merchandise on the basis of *known* standards of grade, weight and measure, so we are prepared to tell advertisers *all* about our circulation.

That's why we belong to *ABC*—to give advertisers an independently audited circulation count and an accurate description of the circulation audience they reach when their sales messages appear in our journal.

The major objective of the bureau's work is to give advertisers accurate, verified information about the net paid circulations of all publisher members. But—its work has also a very real importance to you—our readers.

Our *ABC* reports serve us as editorial guides. We know from the picture of circulation progress shown in the *ABC* statements issued at regular intervals—just what our net paid circulation is. We can study audited reports on how we got that circultaion. We can watch for the circulation changes that tell us how well we are serving you.

By knowing from our *ABC* report the business or occupation in which our readers are engaged, we can arrange our editorial coverage to serve their interests most effectively.

All the other factual information in our *ABC* report guides us in our editorial planning—to bring our readers a useful, interesting publication of the type they want.

To our advertisers, *ABC* means verified circulation information, based on industry-accepted standards and practices. Since the bureau audits only publications with net paid circulation, advertisers know that we stay in business because our readers voluntarily support SERVICE by paying to receive it.

Yes, to attract new subscribers and readers, to get renewals in good measure, we must give our audience the benefits of steadily improved editorial value. Our *ABC* audit of circulation tells us whether or not we've earned the cash ballots—paid subscriptions and paid renewals—that reward editorial initiative and leadership.

We join with the more than three-thousand advertisers, advertising agencies and other publisher members in saluting the *ABC*—who for forty years has served as guardian of circulation integrity.—L. W.

*With apologies to *T. B. Aitken* of Magnavox, who has just completed an extensive report on TVI that will be featured soon in SERVICE.

The Value of TV Chassis TEST POINTS

Comprehensive Survey of Assorted Types of Above-The-Chassis Check Points Included in Current Models, Detailing How They Can Be Used Most Effectively to Expedite In-The-Home Service

by J. C. GEIST

MANY MODERN ELECTRONIC devices such as radar and mobile communication equipment include built-in test points and metering circuits to allow a check of overall performance, while the equipment remains essentially in its operating position. These features have been included in the original chassis design, specifically to reduce out-of-service time by facilitating the application of routine preventive maintenance procedures; their use, particularly in the case of mobile communication equipment, has proven singularly successful. In FM communication equipment, metering circuits are brought out to accessible connectors into which simple test meters can be plugged to show receiver sensitivity, discriminator alignment, and the grid excitation of each stage in the transmitter. It is general practice, with this equipment, to meter these circuits periodically on a regular schedule as a part of preventive maintenance procedures. Through the use of this servicing feature it is possible to make measurements while the equipment is operating en route. Weak tubes can be replaced and simple alignment adjustments can be made without removing the equipment from a vehicle.

This method of servicing has proved to be so efficient and effective that it has often been asked why this approach has not been adopted by all of the TV set manufacturers. In reply, some set makers have noted that the equipment, including these features, has been developed for commercial or combat (Armed Force) use, where out-of-service time is serious and where preventive maintenance tends to become an actual part of equipment use. And then, there is the tendency to cut cost by eliminating every possible part on the high-production, relatively low-cost consumer goods. The real reason, however, is probably because TV receiver manufacture and service is largely an outgrowth of the broadcast set business, and since radios were not so complex as to require these provisions, no serious thought was given to the need for including them in TV receivers.

Recent Developments

As television manufacture, and even more particularly, TV service has grown to a gigantic industry in its own right, the importance of finding more effective ways of providing prompt and reasonably-priced repair service has become generally recognized. In this connection many have also realized that the most effective service for both the customer and the Service Man is that which is performed promptly in the customer's home. Fortunately, an increasing number of maufacturers have begun to include above-chassis test points which can be used for in-the-home servicing.

For some time, because of their inaccessability, tuners have included a test-point connection to the mixer grid. Other typical test points in more recent chassis designs are revealed in Figs. 1 to 4.

The mixer grid test point provided in tuners in a large number of receivers is illustrated in Fig. 1. This test point provides a convenient means of checking the mixer grid bias which is a measure of the oscillator injection. Absence of *dc* voltage or a marked difference in voltage between the *hf* and *lf* channels at this point is usually an indication of a weak oscillator tube. This test point is also the 'scope connection for sweep-generator alignment of the tuner *rf* circuits.

Late model RCA receivers provide a somewhat different arrangement of tuner test points. Fig. 2 shows two simplified schematics of the mixer circuits in late models. In *a* we see the test points in the *vhf* tuner. TP_1 (not accessible to top of chassis) is used for measuring oscillator injection, and TP_2 provides a convenient point for connection of the signal generator in *if* alignment. This point is also the

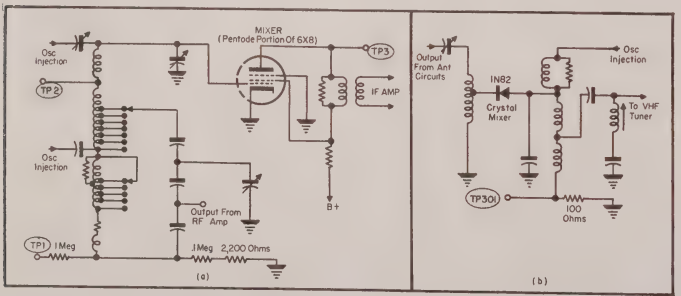
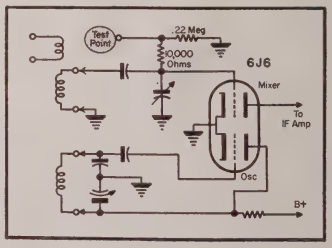


Fig. 2. Tuner test points for RCA KRK 29A/27 uhf/vhf tuner. TP1 = oscillator injection measurement point. TP2 = input connection for if alignment. TP2 = 'scope connection for uhf if alignment. Circuit shown in a is for the vhf section; b, the uhf portion of the tuner.

(Below)

Fig. 1. Test point in a typical vhf tuner.



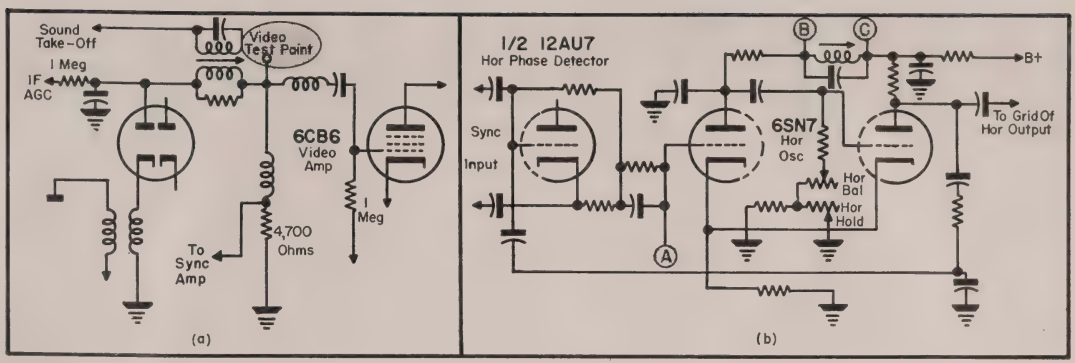


Fig. 3. Test points in Emerson model 760 series receivers. In a we have the video test points; b illustrates the horizontal test points.

'scope connection for alignment of the tuner *rf* circuits. TP_3 is 'scope diode probe connection for use in aligning the *uhf* tuner *if* circuits. The test point to the *uhf* mixer, used for the 'scope connection during tuner alignment, is shown in *b*.

Simplified schematics of additional test points for the Emerson 760 series are shown in Fig. 3. The video output test point, which the Emerson service department explains can be used, in addition to alignment, to determine whether video signal is present, is illustrated in *a*. Since a signal will cause a negative voltage to be developed at this point a *dc vtvm* reading will indicate the presence of video signal. Fig. 3*b* shows the horizontal oscillator test points which allow alignment of the *picture-lock* circuits from the top of the chassis. The Emerson procedure involves adjustment of the horizontal balance control, with points *B* and *C* shorted together, and point *A* shorted to chassis.

The new dip-soldering assembly techniques used in the '54 model G. E. receivers brings all soldered connections to terminals above the chassis. Ten of these terminals are designated as test points for models 21T7 and 21T8: *1*—Converter grid; *2*—grid of first video *if* stage; *3*—grid of sync amplifier; *4*—video detector load; *5*—picture-tube grid; *6*—sound limiter grid; *7*—ratio-detector output; *8*—*if agc;* *9*—sync amplifier plate; and *10*—tuner *agc*.

A top-of-chassis diagram showing the position of these test points is shown in Fig. 4.

More Effective In-the-Home Service[1]

The use of test points, such as those described, can be included in a systematic service procedure to improve generally the effectiveness of in-the-home television maintenance; a profitable goal for every Service Shop.

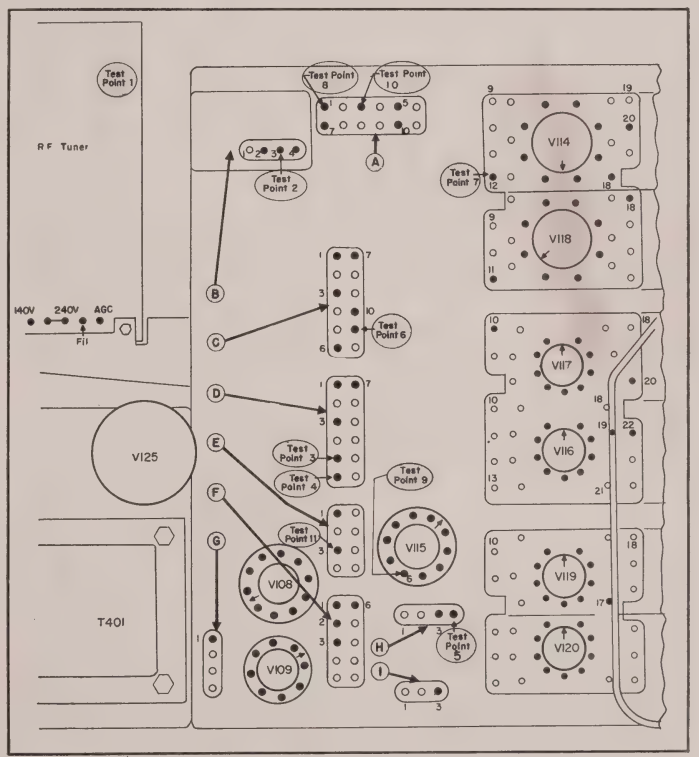
There are a few key points in a TV receiver which provide a good measure of overall performance. The most important of these are: *1*—Power-line voltage; *2*—*B* voltage; *3*—boosted-*B* voltage; *4*—picture-tube high voltage; *5*—*agc* voltage or video-detector output; *6*—sound *if* limiter grid current or ratio detector stabilizing voltage, and *7*—discriminator or ratio detector balance. By the use of test points, when available, and a few auxilliary adapters it is possible to determine quickly the overall performance of a receiver, correct defective and weak tubes, and make minor adjustments without removing the chassis from the cabinet; and with a minimum of hit-or-miss tube pulling. A suggested systematic home-call service procedure is presented below.

(*1*) Receiver should be connected to power source through a voltage-adjuster and metering device, and the

(*Continued on page* 48)

[1]Geist, J. C., *Systematic Servicing*, SERVICE; Nov.-Dec. '53 and Feb. '54.

Fig. 4. Top of chassis test points in G.E. TV models 21T7 and 21T8; these receivers, featuring dip-soldered assembly, have all of their soldered connections above the chassis.



COLOR TV Sync Demodulator Circuits*

THE SYNCHRONOUS demodulators, or detectors, used in color TV receivers are not detectors at all, in the usual sense of the term; instead, they operate as FM-AM conversion devices. If we study the schematic shown in Fig. 1, we find that this circuit actually operates in a linear fashion, and would be regarded more as an amplifier circuit than as a detector circuit.

To understand how the Fig. 1 circuit works, reference should be made to Fig 2, which shows two color video voltages applied to the grid of the synchronous demodulator tube. These are the *I* and *Q* signals, which together carry all the information regarding hue and saturation. The *I* and *Q* signals are fundamentally sine-wave voltages with a 90° phase difference, as shown in Fig. 2. In other words, the *I* and *Q* carriers are in quadrature with each other. If the *I* and *Q* carriers were displayed on a 'scope screen with the aid of an electronic switch, the display would appear as shown in the lower part of Fig. 2.

New Concept in Transmission

This represents a new concept in signal transmission; here we have two separate carrier waves applied to the same grid. Each carrier is separately modulated in amplitude, and carries individual information. How shall the *I* information be separated from the *Q* information?

It is due to the fact that the *I* carrier voltage is in quadrature with the *Q* carrier voltage that separation of the *I* signal from the *Q* signal is made possible by the process of synchronous detection. How this process occurs will be explained graphically by means of vectors.

Fig. 3 shows a vectorial representation of the *I* carrier voltage; it consists of a directed line which has a length equal to the voltage of the *I* carrier. The vector rotates counterclockwise, according to the conven-

(*Continued on page* 50)

Fig. 1. Circuit of a typical I demodulator (synchronous demodulator) used in a color TV receiver. Sometimes called a synchronous detector, the circuit is essentially linear, and is an AM-FM converter. The color killer is merely a bias source, which biases off the demodulator when a monochrome signal is being received.

Fig. 2. At top, I and Q signals are mixed together in the same circuit. The I-carrier and the Q-carrier voltages are in quadrature, or have a phase difference of 90°, as indicated. Illustration below shows how the I and Q carriers would appear on a 'scope screen, with the aid of an electronic switch. The I-carrier is amplitude modulated, and the Q-carrier is amplitude modulated also by a separate signal. These two signals are to be separated by process of sync demodulation.

Fig. 2a and b. In a we see (above) response of the I channel where the bandwidth is 1.5 mc. Below, b, is the response of the Q channel; bandwidth is .5 mc.

Fig. 3. An understanding of the process of synchronous demodulation can be facilitated if we regard the carrier voltage I_c as a standard rotating vector. According to classical electrical theory, the vector is equal in length to the peak voltage of the carrier, and develops a sine waveform by rotating counterclockwise at a rate equal to the frequency of the carrier. At any instant, the value of the sine is equal to the projection of the vector upon the horizontal base line, as indicated.

Fig. 4. When the carrier vector I_c is amplitude modulated, the process is followed graphically by showing the two sideband voltages I_{s1} and I_{s2} added to the carrier vector I_c. At A we see the peak of the modulation, when the resultant is equal to I_{s1} plus I_{s2} plus I_c. And at B appears the change in the situation a moment later, when the sideband I_{s1} has rotated 45° counterclockwise, and the sideband I_{s2} has rotated 45° clockwise; now the sum of the three vector voltages is somewhat less, being equal to I_c plus I_R. The resultant I_R is found by completing the parallelogram determined by I_{s1} and I_{s2}.

[At right]

Fig. 5. Still later, the two sideband vectors I_{s1} and I_{s2} have rotated to right angles with respect to the carrier vector I_c. At this point, the resultant of I_{s1} and I_{s2} is equal to zero, and the voltage of the modulated wave is equal to the voltage of the carrier at this instant.

Fig. 6. Following the progress of the upper and lower sidebands, we now find that I_{s1} and I_{s2} have rotated 135° from their initial positions. Now the resultant of the two sideband vectors subtracts from the length of the carrier voltage vector I_c, making the instantaneous voltage of the modulated wave less than the carrier voltage, as shown.

Fig. 7. When the sideband vectors I_{s1} and I_{s2} have rotated 180° from their initial positions, they then subtract arithmetically from I_c, as shown at B, leaving a resultant of zero, as shown at C. This is the trough of the modulation. Illustration is for 100% modulation.

Fig. 8. The result of the vectorial operation shown in Fig. 7 is to develop a modulated sine wave, which will appear on a 'scope screen as indicated above.

Fig. 9. To represent a quasi-FM wave (such as appears in a synchronous demodulator circuit), the two sideband vectors I_{s1} and I_{s2} are in quadrature with the carrier I_c when they are in phase with one another. In this initial position, the three vectors add up to the resultant I_R, as shown. The essential point is that I_R is not very much longer than I_c. An incidental result is that I_R has a very differential phase from I_c.

Fig. 10. Now the two sideband vectors have rotated 45° from their initial positions, and the resultant I_R does not form quite as large an angle with I_c as in Fig. 9. The length of I_R, again, is only a little longer than I_c. It is evident that a basic phase modulation is occurring, rather than amplitude modulation.

Fig. 11. Here the two sideband vectors have rotated 90° from their initial positions, and cancel each other out. The resultant is now equal to I_c. The length of I_c is unchanged, and the phase angle of I_c is now zero; compare to Fig. 10. The cycle is then repeated as the sideband vectors continue to rotate, and the vector I_c will next incline to the right, instead of to the left, as in Fig. 10.

Fig. 12. The color signal starts as two carrier voltages, which have the same frequency (3.58 mc), but which are 90° apart in phase at all times. It is on the basis of this phase difference that the I and Q demodulators will pick out the I signal or the Q signal at the receiver. The I demodulator will utilize the I signal as AM, but will reject the Q signal as quasi-FM. The Q demodulator will utilize the Q signal as AM, but will reject the I signal as quasi-FM.

Fig. 13. To carry picture information containing hue and saturation, the I and Q vectors must be individually amplitude modulated. Hence, in normal transmission, each carrier vector acquires a pair of sideband vectors, as shown, to transmit an item of I and one of Q information.

Fig. 14. Next, the carriers I_c and Q_c are suppressed, leaving only the two pairs of sidebands to describe the item of I information and the item of Q information. The color signal is transmitted in this form; the missing carriers are supplied at the receiver.

Fig. 15. The final step which takes place at the I demodulator. The missing carrier I_c is supplied at 3.58 mc, and in phase with the carrier which was suppressed at the transmitter; hence, the I signal appears at the output of the synchronous demodulator as the original amplitude-modulated voltage. Of course, the Q sidebands are also present at the grid of the synchronous demodulator, but the supplied carrier I_c appears in quadrature with the carrier Q_c which was suppressed at the transmitter, and hence the Q signal appears at the output of the synchronous demodulator as quasi-FM, and is rejected by the AM-utilizing video circuits; these AM-utilizing circuits regard the quasi-FM as a dc voltage, which disappears in the RC-coupled amplifiers.

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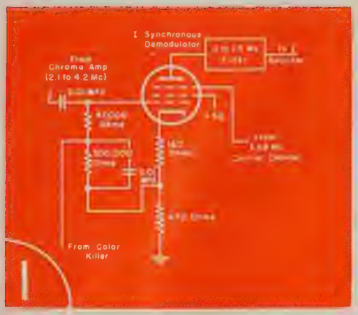
*by **Robert G. Middleton,** *Chief Field Service Engineer, Simpson Electric Co.*



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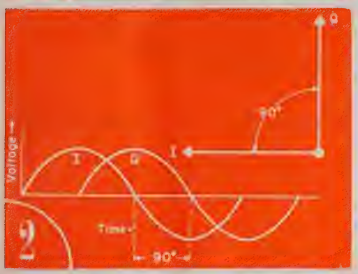

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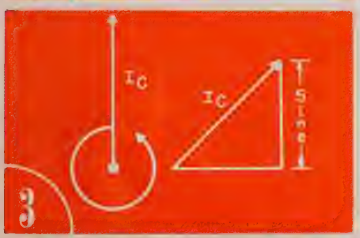

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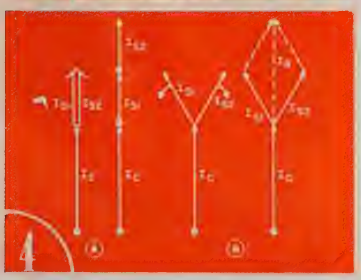

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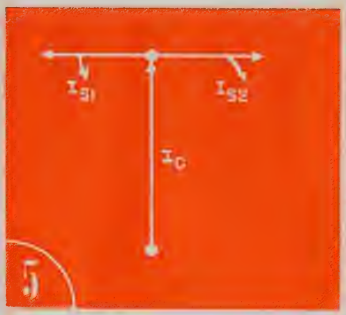

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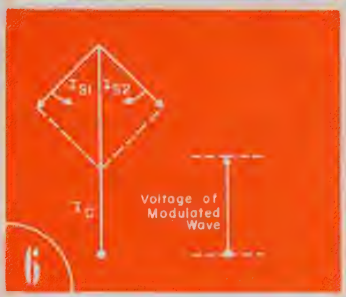

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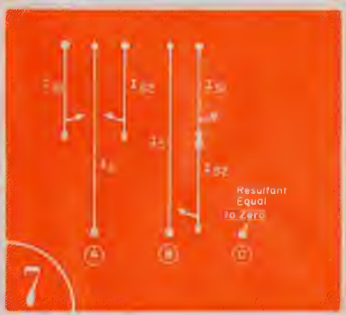

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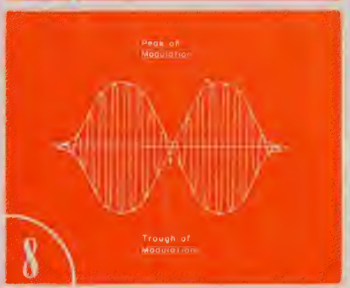

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Fig. 1. Sales and engineering conference at Taco attended by Kendrick Lippitt, chief engineer; Tore Lundahl, sales manager; Sheldon McNeil, sales engineer; Jack Thomas, project engineer and Robert Gallinger, office manager.

Fig. 2. Test site; antennas in foreground transmitting signal to receiving antennas on top of test house.

(Below)

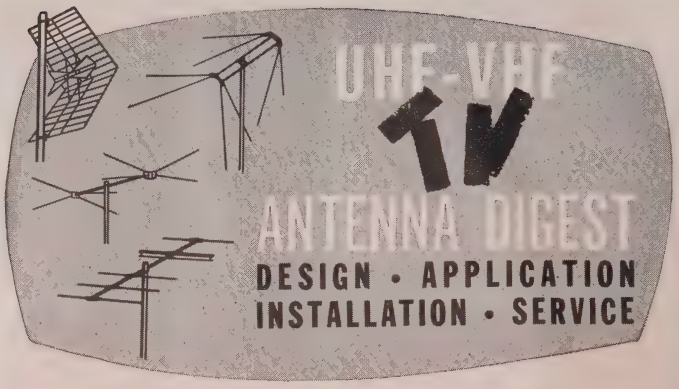
Fig. 3. Standard reference dipole in foreground and new antenna* in rear.

(Below, center)

Fig. 4. Silver-plated reference dipole.

(Below, right)

Fig. 5. Closeup of bracket design for the antenna discussed in report.*



Evolution of Single-Lobe Pattern VHF Antenna‡

by RALPH G. PETERS

THE DEVELOPMENT of a new TV antenna does not start in the lab and is not usually the dream of an antenna development engineer, as most may think. It is not logical for one to develop an antenna, and then to analyze its gain and find that the model can only be used in a few sections of the country. In creating an antenna several factors must be weighed. One must analyze channel allocations and make propagation studies, which might indicate that in the near future a new type of antenna will be required in certain zones. One must also consider the demand for an antenna, that has become apparent in a number of areas, where existing types do not appear to be adequate. Sales and engineering must study these variables, analyze the current demands from the field and then combine these demands with a development program to be carried on in the lab.

When the sales department has decided definitely that a new antenna type is desirable, the design objectives for the new antenna can then be outlined. At this time the engineering department receives a concrete assignment to design an antenna . . . with definite gain requirements for various channels, specific pattern limitations, a basic figure as to maximum and minimum cost for the finished product, and special features required, such as mechanical superiority, ease of assembly, or simplified method of stacking, etc.

At a recent Taco sales-engineering meeting, it was decided that a new type antenna, which must meet the following requirements, was required:

(*1*)—Have a single bay, with a gain of 6 to 8 db for channels *2* through *6* and a minimum gain of 5 to 7 db on the high band channels *7* through *13*.

(*2*)—Provide a single lobe pattern for all twelve channels to provide distortionless color reception; the back lobe should be at least 10 db below the forward lobe.

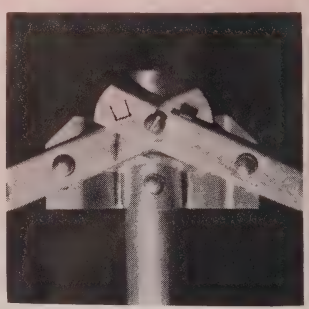
(*3*)—Offer a gain which should not vary more than 2 db from the video carrier to the audio carrier of any channel to fulfill the requirements for color TV.

(*4*)—Model should be completely factory assembled, easy to install, mechanically rugged, have a wind load of

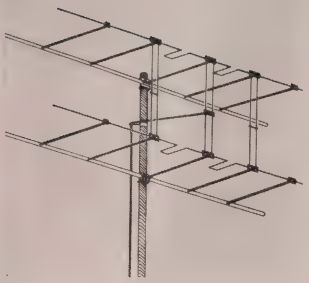
(*Continued on page* 54)

‡*From an exclusive report prepared for* SERVICE *by* ***Kendrick H. Lippitt****, Vice President, Charge of Engineering, Technical Appliance Corp.*

*Taco Shark.



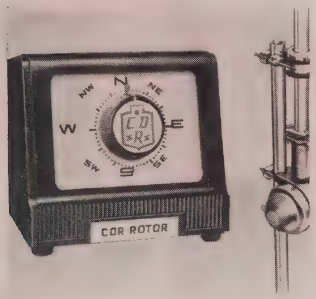
Pictorial Review of UHF/VHF Antennas and Accessories



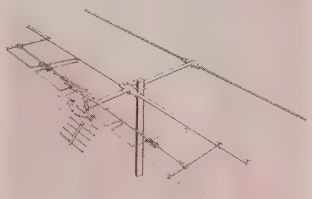
Antenna designed to solve the problems of in-between **TV areas; areas located too close to the station for a super fringe antenna and too far away for an** in town **type antenna. One model, a 2-bay unit, is for close-in and semi-fringe areas. Another type, also a 2-bay unit, serves for close-in and semi-fringe areas which have a front-to-back ratio problem. Both models are double colaterals.** (Models 200-A and 200-SA; The Finney Co., Cleveland, Ohio.)

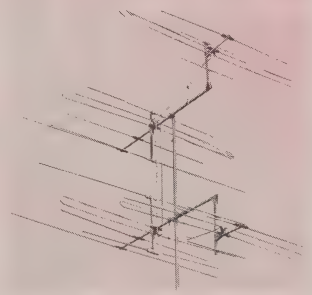
Preassembly feature designed to eliminate need for wing nuts and hardware requiring manual tightening. Heart of preassembly is all-aluminum bracket, fastened to the crossarm, which has an integral leaf-type spring formed in it permitting element to be snapped into place. (Snap-Lock; Channel Master Corp.)

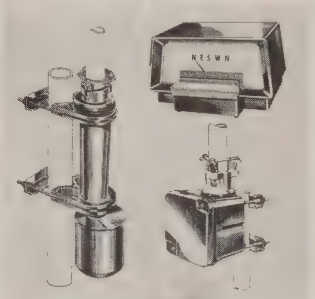
Broad-band antenna-mounted preamp using 6BQ7A's ahead of 6AK5 and 6CB6, claimed to provide 25 db gain on all vhf **channels. With this high output, it is said, shielded coax can be used to reduce further noise pickup on the antenna lead.** (De-Snower Models DSA-132 for channels 2 to 13, and DSA-62 for channels 2 to 6; Jerrold Electronics Corp., 26th and Dickinson St., Philadelphia, Pa.)



Automatic rotor which uses 4-wire cable. One model includes a thrust bearing. Other features include mechanical brake that is released magnetically, self-centering sawtooth clamps, and weather-sealing and factory lubrication. (CDR AR-2 and AR-1; Cornell-Dubilier Electric Corp.—Radiart Corp.)







Antenna rotator said to feature high torque output, no-drift, no-coast cut steel worm gear drive, oil-impregnated cast bronze bearings, and preassembled hardware. Control box has an automatically illuminated dial; lights when the rotator is in operation and shuts off automatically when tuning has been completed. (M-500, M-100; Leader Electronics, Inc., Cleveland, O.)

(Right, above)

UHF/VHF antenna which features preassembled, snap-out design. Has a monolobe **pattern. Constructed of aluminum with rust resistant or plated hardware. The** uhf **portion and the** vhf **reflectors are secured to boom. Antenna is said to be weatherized.** (Monolober; Alliance Manufacturing Co.)

(Left)

Antenna designed around new phasing technique known as dyna-phase, **which, it is claimed, effects unity coupling of all TV bands.** (Vee-D-X Chief Series; La Pointe Electronics, Inc., Rockville, Conn.)

Fig. 6. Vibration test of completed antenna.

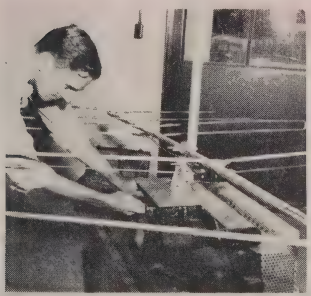
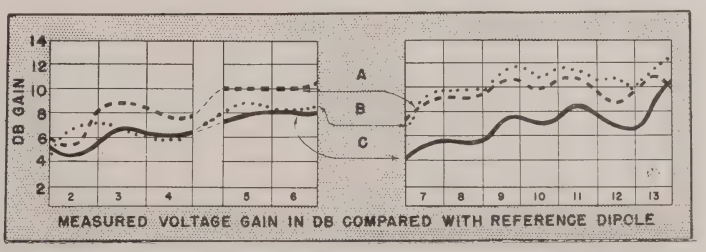


Fig. 7. Gain of Taco Shark antenna for channels 2 through 13. Solid curve (C) represents gain for single bay model; 1845. Dotted line (B) is the gain of two-bay model (1847), with stacking lines 38" long. Dashed-line curve (A) represents gain for a two stack antenna (1848), but with stacking lines 70" long. The gain on the low band for the single unit is between 6 and 8 db on all but channel 2.



This
is
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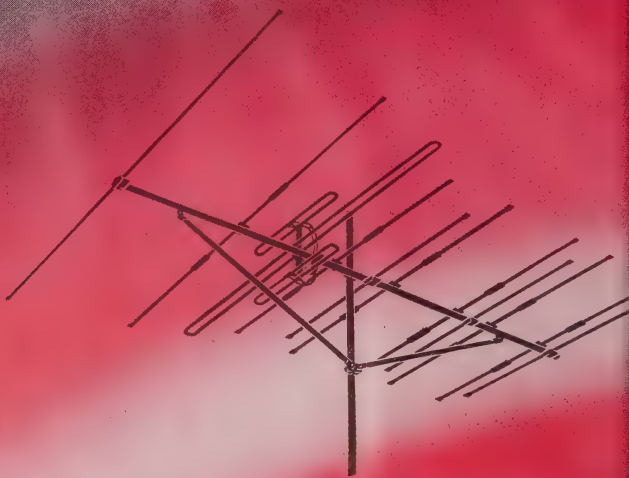
MASTER'S
greatest
antenna
discovery!



the

RAINBOW*

the most important antenna development since the introduction of the basic Yagi!

The World's First
Triple-Powered Yagi...

Brilliant all-channel
VHF performance —
and really ready for COLOR!

Stacked
SUPER RAINBOW
model no. 331

- No other antenna provides such outstanding long distance reception in black and white.
- No other antenna is so well prepared to meet the exacting requirements of color television: Uniform high gain, flat frequency response, extremely narrow polar patterns, highest front-to-back ratios.

Single bay
SUPER RAINBOW
model no. 331

*Pat Pending

Copyright 1954, Channel Master

these 3 basic engineering advances

make the RAINBOW the most powerful all-channel VHF antenna science has yet produced.

1. **New spacing formula:** Channel Master research has now established new, more efficient relationships between the Yagi's parasitic elements (directors and reflectors) — far greater efficiency than a screen. The radical new spacing arrangement between these elements has, for the first time, extended the full efficiency and high gain of the basic narrow band Yagi over the *full width of an entire VHF band.*
2. **New "triple power" High Band directors and reflector:** Three-segment directors and reflectors, with each segment insulated from its adjacent segment, provide the combined power of three High Band Yagis, operating side by side, in perfect phase. This is the first time an *entire antenna* has been made to operate on the same high gain principle as the fabulous Tri-Pole.
3. **New "intermix" design:** Combines — into one single antenna — two separate, *independent* sets of directors and reflectors, one for High Band, one for Low Band. Each parasitic system operates *only* on its own band. No compromise design. No interaction. No signal loss.

PLUS Channel Master's original, super-gain TRI-POLE . . . the unique triple-powered dipole that made the Champion the most wanted antenna in America.

Stacked RAINBOW model no. 330-2

Single bay RAINBOW model no. 330

2 great models available:

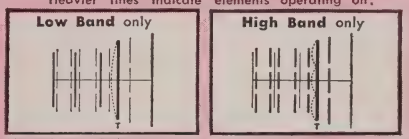
RAINBOW, Model No. 330 — for secondary and near-fringe areas.

SUPER RAINBOW, Model No. 331 — for fringe and super-fringe areas.

Full band width — highest gain — of any all-channel antenna.

Diagram illustrates independent operation of the RAINBOW's High Band and Low Band parasitic elements. Note unique new spacing arrangement between elements.

Heavier lines indicate elements operating on:



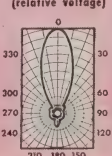
T=Tripole (showing current distribution)

Note that each High Band element is actually three separate elements, each insulated from the others, for triple-powered performance.

Here's how the RAINBOW out-performs the famous Champion.

	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over 1-Bay Champion	1-Bay RAINBOW	0 DB	0 DB	0 DB	+1 DB	+2 DB	+3 DB	+2.5 DB	+1 DB	+.5 DB	+.5 DB	+1.5 DB	+2.5 DB
	1-Bay SUPER RAINBOW	+1 DB	+1 DB	+1.5 DB	+2.5 DB	+3.5 DB	+3.5 DB	+3 DB	+2 DB	+1.5 DB	+2 DB	+3.5 DB	+4.5 DB
	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over Stacked Champion	Stacked RAINBOW	+1.5 DB	+2 DB	+1.5 DB	+1.5 DB	+2 DB	+.5 DB	+.5 DB	+0 DB	+0 DB	+0 DB	+1 DB	+1.5 DB
	Stacked SUPER RAINBOW	+2 DB	+2.5 DB	+3 DB	+3 DB	+4 DB	+.5 DB	+1 DB	+1 DB	+2 DB	+2 DB	+2.5 DB	+3.5 DB

Horizontal Polar Pattern (relative voltage)

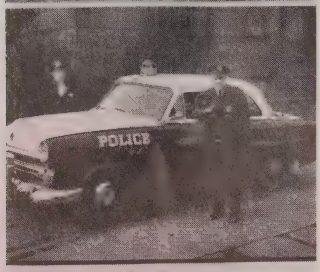


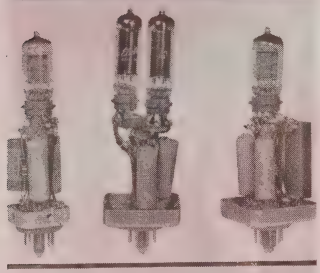
Channel 10

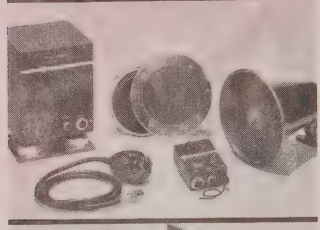
Write for complete technical literature

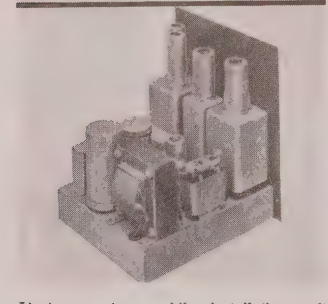
Seen in October Coronet MAGAZINE

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.
THE WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS









At top: custom mobile installation, with microphone attached behind spotlight, for command signals. Speaker under grill. Standard installation for crowd control appears below. Third illustration from top shows plug-in circuits of the mobile amplifying system with shields removed; left to right . . . input stage, push-pull output stage, and balanced voltage amplifier. Next view illustrates the mobile amplifier unit complete, less prefabricated connecting cables. At bottom is interior view of chassis. (Car photos, courtesy Cleveland Police Department.)

Service Engineering
field and shop notes

Packaged Mobile Audio Amplifier System

by **ROBERT M. WOOD**, *Z and W Machine Products, Inc.*

DURING THE DESIGN and development of a packaged audio amplifying system, it was found that two opposing requirements had to be met. There appeared a need for a unit which would be complete, except for power source, and easily adapted for occasional specialized installation. On the other hand, the very nature of the vehicular installation called for easy servicing in the field. Each requirement could be met with existing design techniques; however, one requirement called for design complexity, while the other demanded simplicity.

The need for self-contained completeness was met by evolving a remotely controlled push-pull power amplifier, complete with prefabricated connecting cables.‡ The free use of plug-in components satisfied the second, opposing need; that of easy servicing. The plug-in components included complete audio stages, and the controls were kept few and simple.

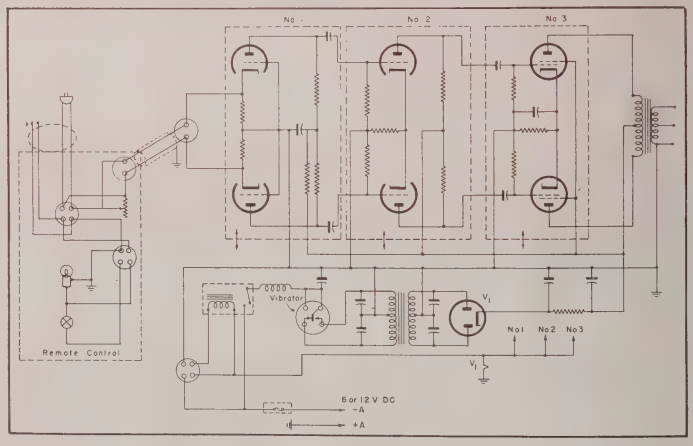
The ease with which the unit could be operated, fitted the conditions of stress and hurry encountered by operators of police, hospital and private ambulances, and by the steadily mounting numbers of civil defense control vehicles. The system's practicability was proven by extensive use in tour buses and large metropolitan sight-seeing bus lines, whose driver-operators kept the system in almost continuous use.

Balanced circuits were included, from the microphone input to the push-pull output stage. A 250-ohm low-impedance microphone was selected and matched through the use of a grounded-grid input stage. This type of input circuit was found to eliminate the need of an impedance-matching transformer on the input stage.

The balanced circuit also served to eliminate the need of a phase inverter for the output stage. This made it possible to exclude a troublesome circuit, since it is very difficult to achieve a perfect balance when using a vacuum tube as phase inverter. Since all common types of phase inverters have a gain of less than one, full use was made of all the available gain in the circuit. The output stage, push-pull 6AQ5,

(*Continued on page* 47)

‡Model 31-A.



(Right)

Fig. 1. Schematic of Z and W model 31-A mobile audio amplifier.

COLOR TV Tube News

Three-Gun 21-Inch Tricolor Picture Tube . . Special Circuitry Features

by E. A. TEVERSON

EVER SINCE the arrival of compatible color TV, tube manufacturers have been concentrating on the development of larger and larger picture tubes.

It has now been found possible to produce a 21-inch round metal envelope model* providing 250 square inches of viewing area.

Other features of the new tube include a shorter electron gun and a wider deflection angle, plus an improved shadow mask and mounting system.

In increasing the diameter of color tubes, and the deflection angle, the tubes have become more sensitive to extraneous magnetic fields particularly near the picture edges. To minimize such disturbances on the smaller types, the tubes have been protected with a conical magnetic shield. This, it has been found, has been effective in shielding the small end of the tube cone, but relatively less effective near the tube face. Also used, in addition to the magnetic shield, has been a rim coil, in the form of a loop placed near the plane of the phosphor plate. The shield has been an item of relatively high cost.

On the 21-inch models, it is proposed to replace the shield and rim coil with a *color equalizer*,* whose effects, it is said, can be controlled at various points around the circumference of the color tube face.

The color equalizer is a sectionalized magnetic field produced by permanent magnets that can be adjusted in position in an assembly placed around the front rim of the color tube. This assembly is separate from the tube itself.

The equalizer consists of two bands of soft iron which serve as pole pieces, operating together with eight permanent magnets. Each of these magnets may be adjusted by rotation in its fixed position on the bands, affording control of the magnetic field near its location. This individual adjustment is claimed to afford selective control around the face of the color tube, permitting compensation for unwanted magnetic fields.

The color equalizer, its designers say, thus permits the electron beams to strike the phosphor dots accurately, and the assembly can be adjusted simply and easily to minimize the disturbing effect of magnetic fields in any location where the color set may be placed.

For the receiver (a 28-tube model) designed especially for the 21-inch tube, three new receiving tubes have been developed: An improved high-voltage regulator tube having simpler structure, and lower filament current than the 6BD4A; a new damper diode similar to the 6AU4GT, but having a higher plate current rating; and an improved horizontal deflection amplifier tube having lower tube drop and with higher plate and grid dissipation ratings than the 6CD6G.

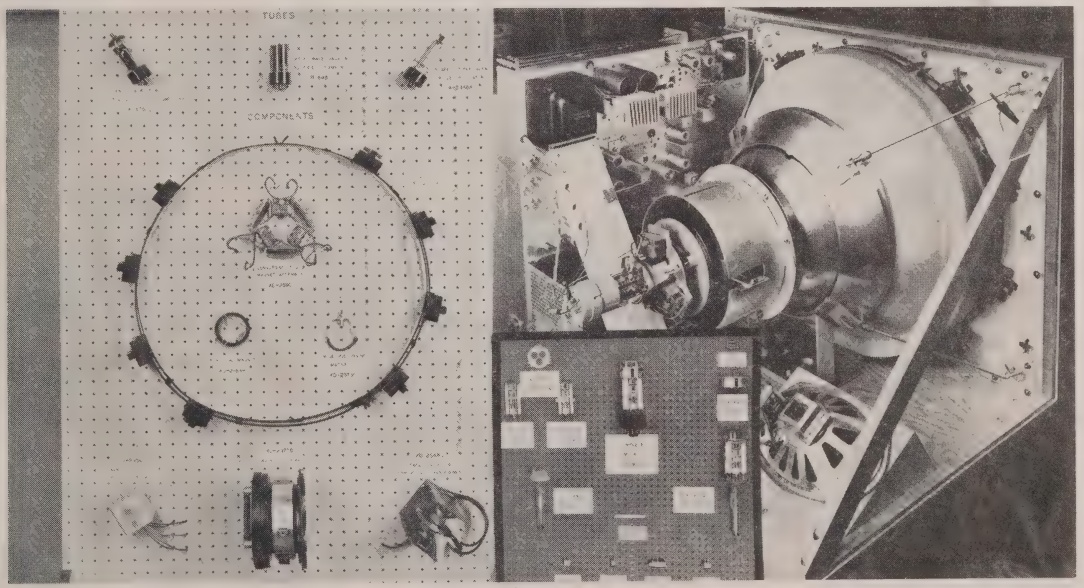
New deflection and convergence circuit components have also been produced for use with the 21-inch tube.

For instance, a yoke was designed to deflect the beam through the greater

(*Continued on page 32*)

*RCA.

Left: **Components for 21-inch tricolor picture tube and associated tubes used in new picture-tube circuit. . . . At top, left to right: Beam power tube for horizontal deflection amp; half-wave rectifier; sharp cutoff beam triode (regulator). In center: Color equalizer with converging coil and magnetic assembly, purifying magnet and blue-position magnet. At bottom: Dynamic convergence inductor pack, deflecting yoke, and horizontal output and hv transformer.** Right center, below: **Components of new internal magnetic pole-piece mount.** Right: **28-tube color set designed for 21-inch 3-gun tube.** (Courtesy RCA)



TV-Chassis Power-Supply Conversions with Selenium Rectifiers . . . Horizontal Hold Improvements . . . Defective Yoke Removal . . . Destaticizing Plastic Masks . . 6CF6 Replacements

by T. L. GILFORD

Replacement of selenium rectifiers in TV sets, although relatively infrequent, often necessitates the removal of the chassis from its cabinet; this operation is quite time consuming, while the actual repair requires little time and is simple. To eliminate this step, some set manufacturers have begun to incorporate adjustable plug-in sockets to receive plug-in rectifiers in the same fashion as tubes. The plug-in rectifiers, as well as the sockets, are so arranged as to insure correct polarity.

According to industry reports‡ there are approximately 28.5-million new sets in operation. A number of these use selenium rectifiers; these chassis can be converted to permit the use of plug-in units. For this purpose one manufacturer has developed a conversion chassis, as illustrated in Fig. 1.

In converting, with this unit, the *black* wire is soldered to socket No. *1*; *yellow* wire to socket *2* and *3*, and *red* wire to socket *4*. Then the conversion chassis can be mounted. The red wire is then connected to the *B*+ point in the television chassis (plus terminal of the input capacitor), and the black wire to the *B*– point in the TV chassis.

If the set uses a half-wave voltage doubler, the yellow wire should be connected to the plus terminal of the series capacitor, C_1; Fig. 2. If the set uses a full-wave voltage doubler, the yellow wire goes to the *ac* line through a 5-ohm surge limiting resistor; Fig 3.

Instead of the procedure outlined in the last three steps, conversion can be made by connecting the leads to the corresponding leads on the rectifiers being replaced.

In the final step the polarized plug-in rectifiers are plugged in and the set is ready for use.

On console models, the rectifiers can be mounted in chassis or speaker compartment; or cool location on chassis. On table models, one should look for a cool location on the chassis.

Horizontal Hold Improvement

An improvement in the horizontal hold circuit has been included in RCA KCS88 chassis. The *synchroguide* circuit has been redesigned in this receiver to provide additional range of control of adjustment. This adjustment has been found to enable compensation for changes in characteristics of tubes and circuit components over a greater period of time of operation.

The correct operating point of this control is obtained by setting the control in the center of the range where the picture stays in sync.

First, the control must be turned to the right (clockwise) until the picture falls out of sync. Then the control should be turned to the left until the picture appears in sync; one should continue turning to the left counting the number of turns the picture stays in sync. Finally the control should be set in the approximate center of this range.

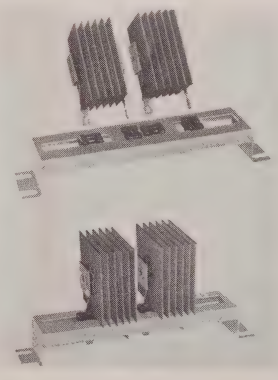
Defective Yoke Removal[2]

Occasionally the Service Men have the problem of removing a defective yoke frozen to the neck of the pic-

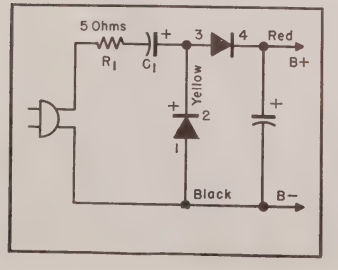
(*Continued on page 47*)

‡NEDA and ARF. [1]Sarkes Tarzian; chassis CCl. [2]From Stromberg-Carlson notes.

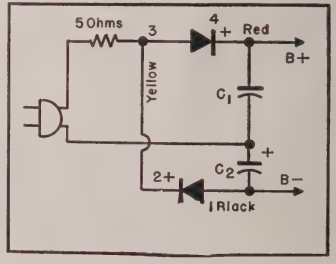
(Right)
Fig. 1. Plug-in selenium rectifier conversion chassis. (Sarkes Tarzian).



(Left)
Fig. 2. Half-wave voltage-doubler circuit.

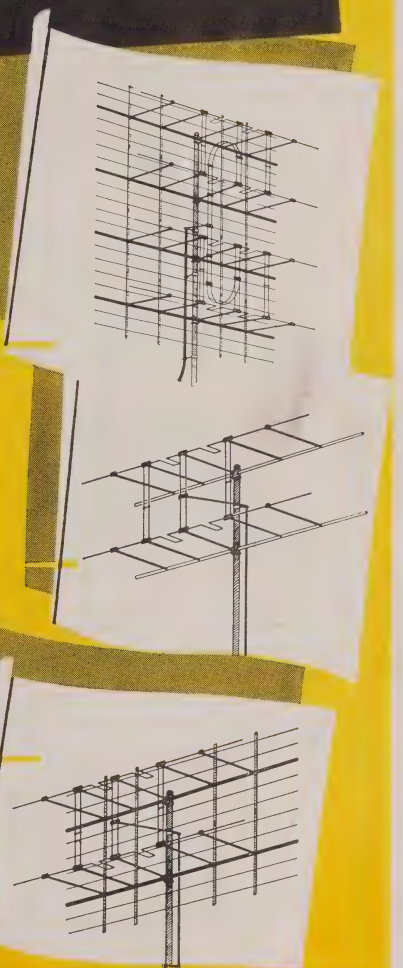


(Below)
Fig. 3. Full-wave voltage-doubler schematic.



FINCO* introduces 3 SENSATIONAL New Antennas

Patent Nos. 2,566,287 2,630,531 2,655,599 other patents applied for.



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The engineering masterpiece of the antenna industry! The sensational, new Finco 400-SA eliminates rear signal interference (adjacent and co-channel), ghosts and electronic noise — delivers famous Finco high gain for clear, sharp pictures in the SUPER fringe area on all channels, UHF and VHF. The special electronic FRO-BAC screen has 80 sq. ft. of highest efficiency, FULL LENGTH reflector surface. Pre-assembled for quick installation.

FINCO 200-A

The ideal antenna for "in-between areas" . . . (too far out to use "Local" type antenna, too close to warrant use of a super-fringe antenna). The new Finco 200-A combines basic, double CO-LATERAL* design with exclusive Finco electronic patents to deliver unbeatable gain and performance in the Semi-Fringe area on all channels, UHF and VHF. Completely pre-assembled.

FINCO 200-SA

The Finco 200-SA was engineered specifically for the "in-between", semi-fringe areas where a FRONT-TO-BACK problem exists. The special FRO-BAC full dimensional screen eliminates rear signal interference, ghosts and electronic noise. This antenna delivers reception power that cannot be matched by ordinary antennas. Completely pre-assembled.

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by M. W. PERCY

SER-CUITS

[*See Front Cover*]

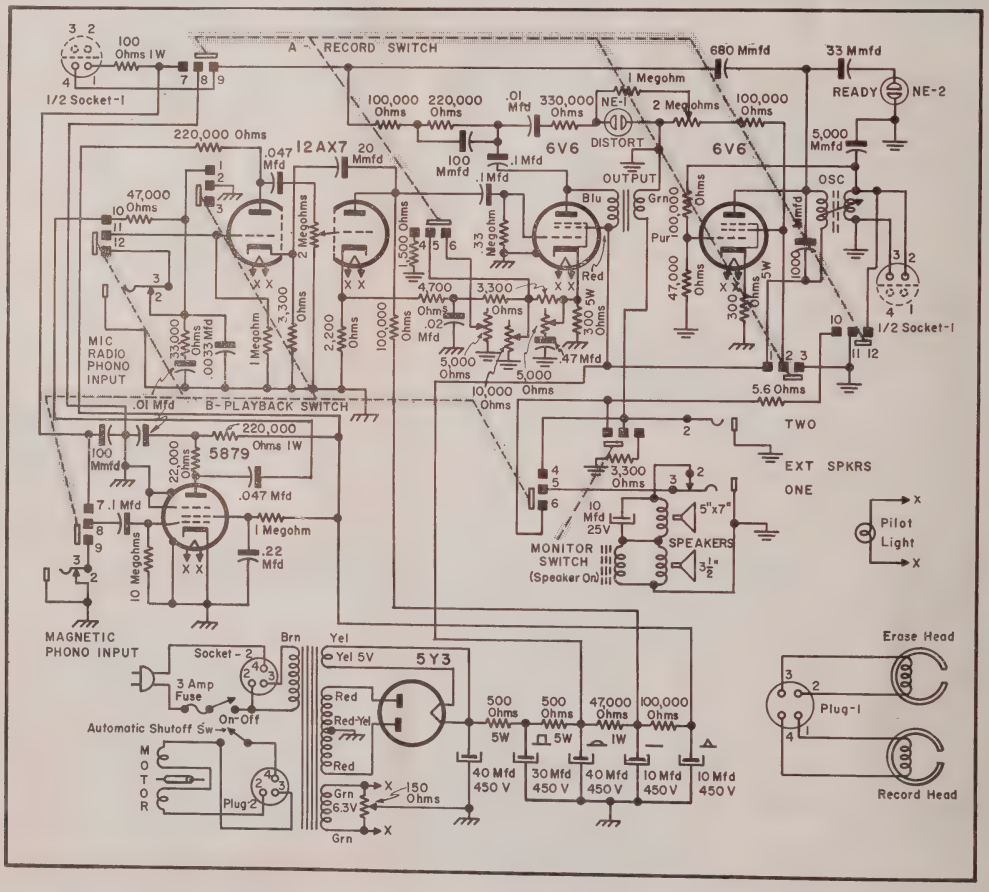
*Four-Stage Hi-Fi Tape-Amplifying System**

IN DEVELOPING amplifiers for tape equipment it has been the custom, in the past, to consider only the feed or playback qualities of the sound system. However, with the increased interest in *hi-fi* the potential use of the amplifier as a nucleus for a home musical system has become an important factor in audio equipment design.

An interesting illustration of the *hi-fi* system trend appears in the schematic shown in Fig. 1 and the *cover*; an amplifier[1] with 4-stages of audio, including a low-noise pentode preamp and oscillator. By means of switching, the amplifier can be set up for microphone pickup for recording or *pa* use; magnetic phono input for loudspeaker operation or transcribing onto tape; tape playback from the internal magnetic pickup head; tape playback

(*Continued on page* 30)

**Fig. 1. Circuit of 4-stage amp in V-M Tape-O-Matic 700.[1]*



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1. *Use the through bolt or machine screw that previously held the replaced rectifier.*

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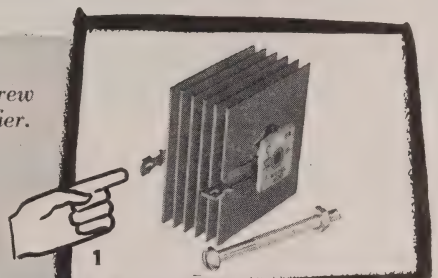
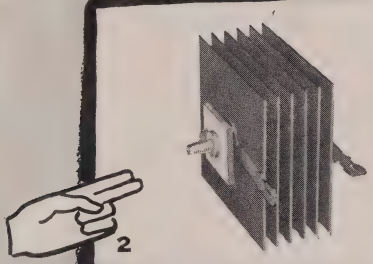
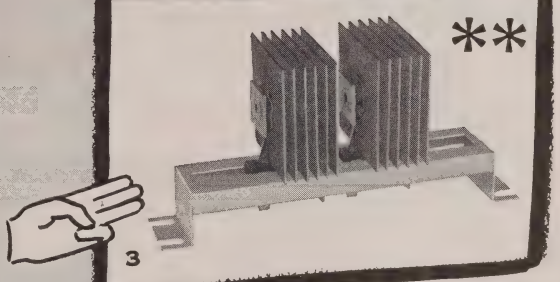




3. *Sarkes Tarzian rectifiers are equipped with "plug-in" type lugs to accommodate even the most modern sets.*
A Sarkes Tarzian exclusive on the replacement market.

plus small, small size



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350X	350	1 11/32"	1 5/8" SQ.
400X	400	1 1/8"	2" SQ.
500X	500	1 11/32"	2" SQ.

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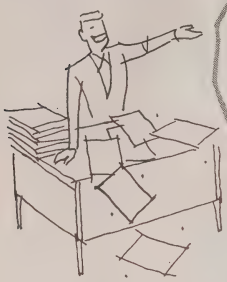
THANK YOU, Mr. Serviceman

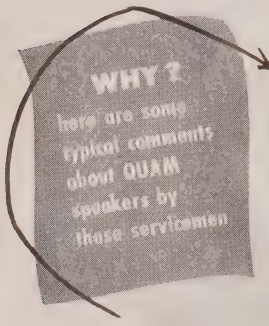
for naming



your preferred brand!

In a recent nationwide survey*, radio and TV servicemen were asked this question: "What brand of replacement speakers do you prefer? Why?" QUAM was first in number on mentions—almost 30% more than the next most preferred brand.

* Conducted by Brand Name Surveys of Chicago, Illinois, May 1954.



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ask for QUAM the quality line, for ALL your speaker needs

QUAM-NICHOLS COMPANY

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Ser-Cuits

(*Continued from page* 28)

directly from any external high-impedance magnetic tape head for purposes of monitoring or tape duplication, and by means of an adaptor attenuator plug, phono, radio or TV programs can be recorded.

The amplifier also provides for the optional use of internal or external speaker for monitoring during recording; or use of two external speakers with optional use of a combination of internal and one external speaker. In addition, one can use an external high-powered amp with an internal resistive load on the output of the tape amp. A compensating load network can be used to eliminate changes in record volume, when switching the monitor speaker system *off* and *on*. An external *vu* (volume units) meter or 'scope can be connected into system; neither, it is said, is affected by monitor-speaker-system switching. Amplifier has unique bass boost circuit which, the designers say, provide 20 db of bass boost without the use of additional amplifying stages.

In the amplifier there is also an adjustment provision for recalibrating the flash point of the record volume indicator; an indicator light operated by record bias frequency serves as both a warning that erasure is taking place and an indication that the oscillator is in working order. An auxiliary adjustment control allows variation in the amount of bass boost control available from full rotation of the normal bass-boost knob. Six db of treble pre-emphasis and post-emphasis can be achieved by adjusting the treble boost knob.

By means of a 100-ohm resistor built into the ground return of the record head, it is possible to measure bias current at the head.

An external hum adjustment has been included to compensate for hum pickup induced from tape playback head, variable-reluctance phono cartridge, and external tape playback head. Hum induced by a high-quality dynamic microphone can also be minimized. (Normally, this control is adjusted for minimum hum pickup with the internal tape playback head; however, for extremely critical operation, it can be temporarily readjusted for any of the heretofore mentioned services.)

Amplifier Circuit

To obtain rippleless *B* supply even at the plate of the power stage, three sections of filter have been included before any *B* supply is furnished, with an additional two stages for decoupling of the preamp stage. This has been found to allow the signal from the output stage to be fed into any booster amp with extremely high signal-to-noise ratio, even at lower power outputs.

The first stage of the preamp consists of a 5879 low-noise pentode with two separate equalizing networks; a high roll-off network for deemphasis of hiss and noise on tape playback, and an additional network for use only in magnetic phono input service. (This network is automatically switched out of service on tape playback.)

The microphone input is fed into the first section of a 12AX7. For maximum simplicity, crystal phono, as well as radio and TV signals are fed into the same microphone input, but through an attenuation network in the phono adaptor plug. This consists of a 10-megohm series resistor which, together with a 1-megohm grid resistor of the 12AX7, provides a 20-db attenuation pad. The output of this stage is then fed into the volume control and then to the 12AX7 driver section. The output of the driver section is fed back by means of a 20-mmfd capacitor to the cathode of the first section of the

(*Continued on page* 46)

ANNOUNCING A COMPLETELY NEW LINE OF STAND-OFFS THAT'S . . .

E-Z To Use... Stay Locked In!

SOLID INSULATOR— NOT CORED OUT; METAL SURROUNDS LEAD-IN!

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E-Z "Swing In"

UHF-VHF STAND-OFFS

- SOLID POLYETHYLENE INSULATORS—WILL NOT COLLAPSE OR PULL OUT
- COMPLETELY ASSEMBLED—READY TO USE
- CHOICE OF 33 DIFFERENT STYLES AND SIZES
- IDEAL FOR ALL LINES—ALL INSTALLATIONS

OPEN . . . insert lead-in (any kind)

CLOSED . . . insulator locked securely

E-Z to use . . . E-Z to swing into place . . . and sure to stay locked in because of their exclusive lock-in feature! These new TELCO E-Z Stand-Offs are supplied ready to use . . . no fumbling for separate components, no need for pliers or special tools. Best of all, they minimize transmission loss from antenna to receiver . . . especially important on your UHF installations. Get TELCO E-Z Stand-Offs at your favorite distributor . . . or have him get them for you!

WOOD SCREW TYPE
EZ8027....3½"
EZ8028....5½"
EZ8029....7½"

MACHINE SCREW TYPE
EZ8031....3½"
EZ8032....5½"
EZ8035....7½"

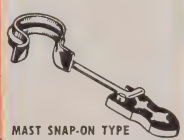
"KANT STRIP" MAST TYPE Galvanized Straps
EZ8253....3½"
EZ8254....5½"
EZ8257....7½"
EZ8258....7½" Double Inline
EZ8259....7½" Double T-Type
EZ8395....7½" Triple Type

"KANT STRIP" MAST TYPE Stainless Straps
EZ8353....3½"
EZ8354....5½"
EZ8357....7½"
EZ8358....7½" Double Inline
EZ8359....7½" Double T-Type
EZ8396....7½" Triple Type

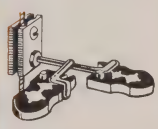
DOUBLE INLINE TYPE
EZ8225....7½" Wood Screw
EZ8226....7½" Machine Screw

DOUBLE T TYPE
EZ8809....7½" Wood Screw
EZ8810....7½" Machine Screw

TRIPLE TYPE
EZ8397....7½" Wood Screw
EZ8398....7½" Machine Screw



MAST SNAP-ON TYPE
EZ8798....3½" for 1¼" Mast
EZ8795....7½" for 1¼" Mast
EZ8796....7½" Dble. Snap-On Inline for 1¼" Mast



GUY WIRE CLAMP TYPE
EZ8255....3½" Single
EZ8256....7½" Duplex Inline

EAVE CLAMP TYPE
EZ8811....3½" Single
EZ8813....7½" Single
EZ8812....7½" Double Inline
EZ8815....7½" Double T-Type

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CO-TRAP gives highest FRONT TO BACK RATIO of 5 major competitors!

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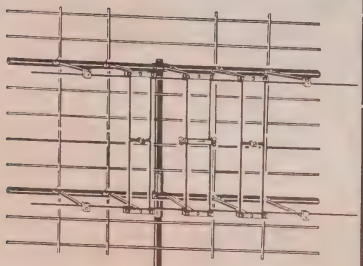

AMAZING FRONT TO BACK RATIO TEST DATA

FREQUENCY (Megacycles)	RELATIVE VOLTAGE-DB	
	2-bay Model 701 (Without "Co-Trap" Screen)	Skyline Imperial Model 701-CT (With "Co-Trap" Screen)
50	9.12	10.1
60	9.4	18.1
70	9.4	14.
80	6.8	14.8
90	7.4	14.8
170	3.5	12.9
180	5.1	14.
190	6.4	21.9
200	4.1	16.9
210	4.1	14.
216	3.5	20.

Independently tested by the Research Division of Mark Products Co. of Chicago. Edward F. Harris, Chief Engineer.

Patented

CHARACTERISTIC VHF BAND PATTERNS with "Co-Trap"

Channel 9

Channel 4

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Side-by-side comparison test proves "Imperial" far superior at rejecting co-channel interference!

Two competitors failed completely—pictures entirely blotted out.

Another two showed inferior pictures and much interference.

Coming through with flying colors, the "Imperial" gave a clear picture free of interference.

Full size 5000 square inch screen.
All aluminum—extra heavy throughout.
Completely pre-assembled.

MODEL No. 701-CT
(2-bay, with "Co-Trap" screen)

LIST **$27.50**

MODEL No. 700-CT (4-bay, with "Co-Trap" screen) also available—$57 list

SKYLINE MFG. CO. 1652 Rockwell Ave., Cleveland 14, Ohio

Tube News

(*Continued from page 25*)

angle of the 21-inch tube. And a new horizontal-output and high-voltage transformer provides picture-tube voltages, using only three rectifier tubes.

The 21-inch receiver uses two high-voltage rectifiers in a doubler circuit. The vertical deflection amplifier is two triodes in parallel.

Several circuit innovations have also been included in the new chassis. The receiver utilizes an automatic chroma control said to eliminate signal (color) fading caused by planes.

The color demodulator serves to select the intensities of the transmitted colors and passes them on simultaneously to the proper control elements of the color tube. It consists of two triodes in one envelope. One triode acts as a synchronous switch to sort out the red and the other to sort out the blue; both triodes act together in reverse phase for green.

* * *

RICHARD T. ORTH, formerly vice president of RCA and general manager of the tube division, has joined the Westinghouse Electric Corp. as vice president in charge of the electronic tube division.

PERSONNEL

DOUGLAS H. CARPENTER, chief antenna engineer for JFD Manufacturing Co., Inc., has been named chairman of the RETMA R-17 antenna committee.

* * *

B. V. K. FRENCH is now service manager of the Regency division of I.D.E.A., Inc., and will be in charge of all technical writing, and correspondence on service problems.

* * *

JACK E. WILLSON is now audio products manager for the National Co., Inc., Malden, Mass. He was formerly sales manager for the Collaro division of Rockbar Corp. . . . ROBERT J. CALDWELL has been named new products manager.

Jack Willson

Robert S. Burros

* * *

ROBERT S. BURROS has been appointed advertising and sales promotion manager of Olympic Radio and Television, Inc., Long Island City, N. Y.

* * *

DR. PAUL ONCLEY is now audio development engineer for the Kay Electric Co., Pine Brook, N. J.

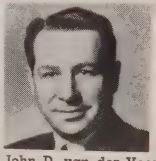
Dr. Paul Oncley

Everett E. Leedom

EVERETT E. LEEDOM has been named advertising manager of Electro-Voice, Inc., Buchanan, Mich.

* * *

JOHN D. VAN DER VEER, formerly manager of initial equipment electron tube sales, is now assistant general sales manager of Tung-Sol Electric Inc., Newark, N. J. . . . J. M. MALONE has become assistant manager of initial equipment electron tube sales. . . . ARTHUR KECKEISSEN succeeds Malone as manager of the production, order and service department.

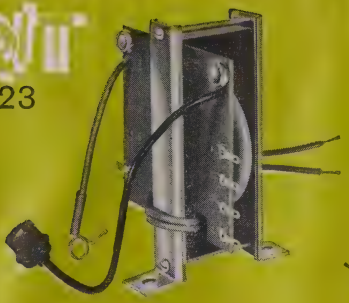


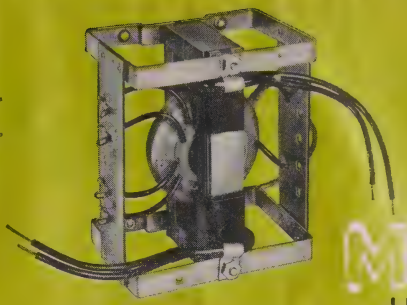
John D. van der Veer

Paul Newton Cook

PAUL NEWTON COOK has been appointed jobber sales manager of the Chicago Standard Transformer Corp. He will direct activities of the Chicago and Stancor jobber sales divisions.

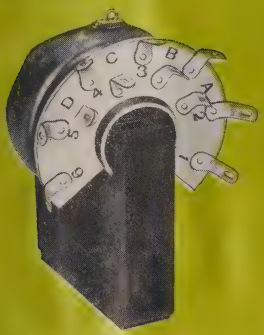
MERIT
HVO-23





MERIT
HVO-16

MERIT
HVO-13



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Ask your jobber, or write for, your copy of Merit 1955 Replacement Guide #407 listing up-to-date replacement components for all models and chassis of TV receivers.

WATCH

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AS IT HAS BEEN IN BLACK & WHITE TV SINCE 1947

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4427 N. Clark Street, Chicago 40, Illinois

Burton browne advertising

THE 980 LINE

Model 985 Calibrator—$199.50

Model 983 Oscilloscope—$329.50

Model 984 Sweep Generator—$199.50

Representing an entirely new approach in test equipment design and operation, the 980 Line instruments have brought new *simplicity* and new *time-saving facility* to TV receiver alignment and servicing. Now available to TV technicians through leading distributors. Literature giving complete information on request. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.

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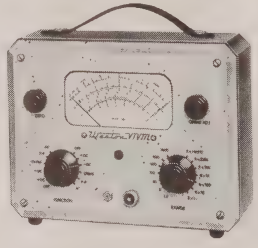
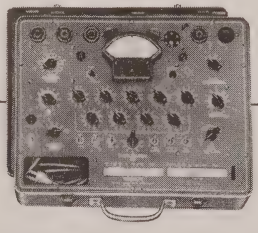


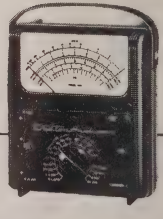
Model 982 Vacuum Tube Voltmeter—$69.50

WESTON

TEST EQUIPMENT



Model 981 Tubechecker—$199.50



Model 980 Analyzer—$52.50

SERVICE...The National Scene

ANNUAL TV SERVICE INCOME EXPECTED TO JUMP TO $2-BILLION IN 5 YEARS--Members of a service association in Atlanta, Ga., were told recently by the national director of service of a leading set maker, that if the estimated production of b-w and color chassis holds for the next five years, placing 44,000,000 monochrome and between 10- and 18,000,000 polychrome receivers in the field, income from the TV service business could well exceed $2-billion dollars per year by '59. . . . The increased number of video models, the southern group was told, will eventually require a servicing force of at least 200,000 to handle adequately industry requirements at the consumer level. . . . Color will place quite a burden on the Service Man, continued the service manager, for he will have to spend about two hours with each receiver, in contrast to less than an hour (average) with b-w models. And color chassis are expected to require about six to ten calls during the first year, compared to about the two, now standard for black and white. . . . Success or failure in service, the Service Men were warned, will continue to depend on the desire to succeed (the motivation must be present), technical ability (there is no substitute for know-how), business ability through the maintenance of proper records and controls, and human relations or the proper handling of customers and employees.

OVER $250-MILLION REPLACEMENT PART SALES RECORD PREDICTED FOR YEAR--In a recent address before an analysts group in Chicago, the prexy of one of the nation's largest set and tube makers said that the steady growth of the electronic business has boomed the sales of replacement components and tubes during the year, and as a result, the volume could add up to over $250-million. By '57, it was said, sales will zoom to over $450-million. . . . And servicing and installation, which has grown from $145-million in '46 to $1.4-billion in '53, will, it was forecast, continue to set a pace and become a multi-billion dollar business within the next five years.

SURVEY REVEALS THAT MILLIONS OF RADIOS ARE OUT-OF-ORDER--A recently-completed study by a research group, conducted for broadcasters, has disclosed that there are now over 14-million household radios and over 2-million auto sets that are not in working order. The defective house receivers were said to be located in over 11-million homes.

OVER 800,000 TV SETS were also found to be in need of service, the experts found. . . . Sets temporarily incapable of reception were classified as out-of-order, even if they were to be repaired immediately. TV sets, which could receive a pix but no sound, were counted as working chassis. . . . The study was based on a stratified probability sample of households designed to be self-correcting for population changes since the 1950 census. . . . Describing the field work approach, the surveyists reported that, within about a month's time, personal interviews were completed in over 11,000 households located in over a thousand different sample segments distributed over 140 counties in 70 primary sampling units. To insure accuracy, it was said, personal room-by-room inspections were made in over 1200 designated households. Specifically, the study showed that over 90% of the homes included in the sample provided information and consented to an inspection of their equipment.

IN AN ANALYSIS OF THE RADIOS now in use, the interview specialists said that there are over 25-million sets installed in living rooms; over 21-million in bedrooms; over 16-million in kitchens; over 4-million in dining rooms; nearly 1.5-million in dens, studies and libraries, and over 26-million in automobiles. The foregoing also includes about 5-million portables with, of course, no fixed location.

TV CHASSIS ownership, the pollsters found, was highest in the northeast, where 71.6 per cent of all households have one or more sets. In the south only 44.4 per cent of the homes were found to have TV sets. . . . At present, the survey disclosed, there are over 100,000,000 radios and over 28,000,000 TV sets in operation.*

* Based on copyrighted information, extracted from review of survey conducted for Advertising Research Foundation by Alfred Politz Research, Inc.

SERVICE...The National Scene

OFF-CHANNEL/ON-CHANNEL (SATELLITE-SLAVE) STATIONS PROBED AT CONFERENCE--Plans to push ultrahigh and veryhigh signals into those areas blacked out because of geographic conditions are moving along swiftly, according to a body of experts who appeared on a satellite forum, conducted by ye editor in Cleveland recently, under the auspices of the IRE professional group on broadcast transmission systems. . . . It was reported that all of the transmitters, installed to explore the possibility of extending uhf as well as vhf coverage, have been extremely successful in wiping out reception holes.

COMMENTING ON THE ADVANTAGES of stepped-up signals, through on-channel slaves, the director of research of a telecaster in Nashville said that a station providing this service requires no additional channel space, provides strong signals over towns to be served, produces negligible interference to the stations boosted and to other co-channel and adjacent-channel stations, and can fit easily into a national allocation plan to insure service to as many as is economically feasible.

DESCRIBING THE SOUTHERN REMOTE, the broadcaster said that the system consists of a high-gain receiving antenna and a relatively low-gain transmitting antenna, placed back-to-back and connected together through a low-power radio-frequency amplifier system, which has an overall gain of approximately 120 db. . . . A vertically-polarized booster transmitting antenna has been installed to maximize station coverage for a given booster power and to minimize interference to the main station and other standard co-channel stations. Using vertical polarization was also found to minimize feedback problems, and allow the booster receiving and transmitting antennas to be placed relatively close together, about 500 to 1000 feet.

INTERFERENCE, which did obtain in some locations, was solved, the engineers were told, by installing new antennas or implementing present types. . . . To illustrate, where the booster signal was about twice the main station's signal, satisfactory reception was assured through the installation of conventional dipole-reflector antennas or three to five-element yagis. These were installed in a vertical position, usually about ten to twenty feet above the ground.

WHERE THE MAIN STATION'S SIGNAL was subject to wide fading ranges, and noisy pictures were common, and when the booster caused ghosts and pix rolling, a five-element yagi mounted in a vertical position was found to cure the trouble. . . . In some installations, the wire guy lines were found to be troublesome, reradiating signals from both main and slave transmitters. This annoyance was curbed by replacing the wire with guys made of nylon rope that was three-sixteenths inch in diameter and offered a tensile strength of 600 pounds. Springs were used at the lower end of each rope to insure the guy's remaining taut in all kinds of weather.

REPORTING ON THE RESULTS of a uhf slave operation in Jackson, Mississippi, the station's chief engineer said that the additional transmitter has made it possible to spread signals to most of the hollow spots in the bluff areas. . . . The value of step-up adjunct transmitters was stressed, not only because of the low-powered key stations that are still in operation, but because of the propagation problems that exist on the higher channels.

ACCORDING TO THE CHIEF OF THE FCC BROADCAST bureau, the on-or-off-channel retransmission idea should provide a practical means of expanding video service. It should help, he said, in bringing reception, for the first time, to shadow zones, and also improve results for many set owners who have had to be content with snowy and shifting pictures. . . . Policy is still to be set on power, zone distribution, types of transmission and program origination. An official ruling should be released before the year is out, the Commission spokesman said.--L. W.

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It would take a dozen ads to tell you *all* about *all* of them. Because there are so many fine, new CBS-Hytron business builders. And there is so much you'll want to know about every one.

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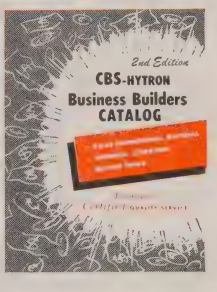

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Bigger, better Seventh Edition of this perennial favorite is now ready! This CBS-Hytron original lists *all* miniatures to date, regardless of make. Contains: 329 types, 79 new. 134 basing diagrams, 27 new. Twelve packed pages of data you need daily. And it's FREE!

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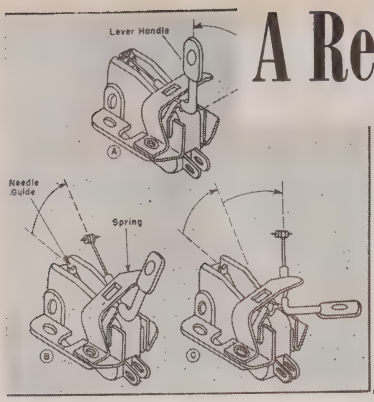


A Report on PHONO NEEDLES

by WYN MARTIN

Part II: Changing the Needle..Needle Assembly Design..Properties of All-Groove Stylus Tip, and Thorn and Cactus Needles

(Above)
Replacing needle assembly in Titone turnover cartridge. Needle is removed as illustrated in A by rotating turnover lever handle to middle position at right angles to normal operating position. Then needle lever arm is rocked back against spring, and front of needle is lifted out of needle guide, partially disengaging rear portion of lever arm from bearing at rear of cartridge; B. With needle thus disengaged, lever arm is turned 90° so that handle points away from installer, and with a twisting motion needle lever arm assembly can be separated from pickup; C. To insert needle, lever arm is held with handle pointing away from installer, and curved portion is forced under spring and into bearings at rear of pickup, pressing up against spring; C. With lever arm in bearing, lever arm is rotated toward installer, so that it is in a position midway between either operating position, but rocked back against spring so that needle point does not engage needle guide; C. Then needle point is lowered so that it is firmly held in needle guide; A. In final step, lever arm is rotated to desired operating position. (Courtesy Sonotone)

(Below)
Removing and replacing needle in Astatic type A cartridge, where needle is held in place by friction. To remove, the edge of a knife or tip of a small screwdriver should be used to pry out needle. In installation, needle should be pushed gently into place, and pressure applied only to vertical shaft. (Courtesy Duotone)

(Right)
The lateral displacement of a needle by groove modulation (exaggerated) is shown in a. Flexing of the vertical needle shaft which prevents groove modulation force from being communicated to the needle chuck and cartridge is illustrated in b. A horizontal shank needle design is shown in c. All of the lateral force of the groove is communicated to the needle chuck as an axial twist, while the vertical compliance of the horizontal shank keeps much of the vertical groove force from the cartridge.

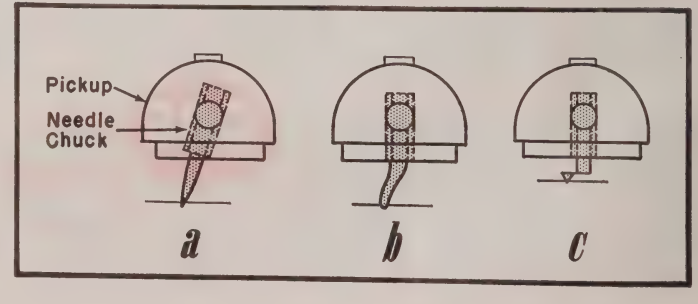
THE RATE at which a needle tip of given material wears is dependent on many factors; the type of pickup arm and whether it is mounted correctly, the condition of the records being played, the tracking force, etc. Service Men can keep track of the condition of needle tips by carrying a pocket microscope with them, and changing needles when a significant flat or worn surface develops. Many different figures have been given as to the expected playing time of needle tips of the three main materials. The Service Man should check for wear after perhaps 10 hours of use of an osmium tip; 25 hours for a sapphire tip, and 500 hours for a diamond tip. The life expectancy of a needle, paradoxically, is lower in a high-fidelity system than in a commercial phono, because although the conditions of record play may be at optimum in the former case, the results of worn needles become evident much sooner, by virtue of the extended frequency range and low distortion of the reproducing system.

The figures given relative to hours of use are very rough and almost arbitrary, but they provide a scale on which many phono experts agree; the diamond tip, while involving a much greater initial expense, is the most economical in the long run. Many *hi-fi* installations use diamond for the microgroove stylus and sapphire for the 78 *rpm* needle, since it is expected that the latter will receive less use.

Design of the Needle Assembly

The needle assembly consists of a shaft which communicates motion of the needle tip to the cartridge, a base on which the needle can pivot, and in some cases damping material, provided for the purpose of subduing mechanical resonances. The perfect needle assembly can take up all vertical motion in itself, passing on none of this motion to the cartridge, but is perfectly stiff for lateral motion, so that all of the groove modulation forces are conveyed to the cartridge.

Below, in an exaggerated way, is illustrated how a long vertical shank can flex at high frequencies, and will not faithfully transmit the motion of the stylus tip. This is the reason that most modern needles are of the bent shank type, in which the vertical section of the needle shaft is very small, and in which the lateral shaft has high vertical compliance, but high lateral stiffness. This design principle is carried even further in some designs by having all of the work done at the needle tip itself, the lateral shaft being only for the purpose of connecting the needle tip to the pivot. The G. E. magnetic pickup was an early example of such design; now Rochelle salt and



ceramic pickups are also made this way.

Where a record player has an older type pickup with needle chuck and set screw, performance can often be improved by the use of a new type needle with a lateral shank. The lowering of vertical response of the cartridge-needle system will have the effect of reducing surface noise without marring treble reproduction, and of cutting down cartridge distortion. The needle with a high vertical compliance usually cuts down on the overall output of the cartridge, but severely reduces *needle talk*, the noise radiated mechanically from the vibrations occurring between the needle and the compliant record material.

The All-Groove Stylus Tip

The all-groove needle is a convenience, making it unnecessary for a phono operator to change cartridges or to flip levers when changing from standard to microgroove records. Its use is not generally recommended for *hi-fi* installations, however, because of the danger that the sharper corners of the truncated shape will wear the groove more than a spherical tip would, and also because of higher distortion.

Thorn and Cactus Needles

Needles made of relatively soft material, such as wood, were quite popular before the war. The theory was that the needle tip, being softer than the record, would not wear the record. Most users of these needles were cautious about using hard-tipped needles, for fear of record damage.

Needle Tips and Record Wear

It has now been clearly established that excessive record wear is primarily due to a needle tip that has lost its spherical shape, rather than to a perfectly-formed tip which is made of hard material. Hard materials such as sapphire and diamond, as a matter of fact, have a positive advantage in that they can be polished to a very smooth surface, keeping friction and wear to a minimum.

HF Absorption Thru Shank

Fiber or wood needles do cut down the record surface noise, as their shanks absorb much of the high-frequency content in the record. This reduction of surface noise is thus at the expense of good treble reproduction.

[Next Month: Assembly Standardization]

SHURE

3 NEW crystal pickup cartridges replace 210!

AT A TOTAL COST OF ONLY $18.00 LIST

The MODEL W68
replaces 41 Crystal Cartridges made by the five leading manufacturers.

The W68 is a "Muted Stylus" type, Dual-Weight Cartridge. The dual weight makes it possible to replace either aluminum or steel case cartridges—without adjusting tone-arm balance. With weight slug net weight is 25 grams; without weight slug net weight is 12 grams. The W68 is equipped with the famous A62A silent-tracking, "Muted Stylus" needle.

STANDARD CARTRIDGE FOR 78 RPM RECORDS

MODEL NO.	TYPE	LIST PRICE	OUTPUT LEVEL	MIN. NEEDLE FORCE	RESPONSE TO	NET WT.	SHURE NEEDLE NO.
W68	Crystal	7.50	1.6V	1 oz.	4,500 c.p.s.	Dual Weight 25 grams or 12 grams	A62A

The MODEL W78
replaces 149 Cartridges made by the five leading manufacturers.

Model W78 is a Dual-Volt, Dual-Weight Cartridge—so versatile it replaces 149 other cartridges! This cartridge alone will become a sensation overnight—because it replaces steel or aluminum case cartridges, of either high or low output! The W78 provides the broadest coverage at the lowest investment—only $5.55 list.

General Information: With weight slug, net weight is 25 grams; without weight slug, net weight is 12 grams. In addition, Model W78 has a capacitor, furnished as an accessory. Without capacitor, output is 4.0 volts; with capacitor, output is 2.0 volts.

STANDARD CARTRIDGE FOR 78 RPM RECORDS

MODEL NO.	TYPE	LIST PRICE	OUTPUT LEVEL	MIN. NEEDLE FORCE	RESPONSE TO	NET WT.	SHURE NEEDLE NO.
W78	Crystal	5.55	4.0V or 2.0V	1 oz.	6,000 c.p.s.	Dual Weight 25 grams or 12 grams	None

The MODEL W70
replaces 20 "Special" Cartridges.

Model W70 is a completely new cartridge in the Shure line. It replaces all the Webster "CX" and "C" Series Cartridges, comes equipped with all the necessary accessories. The W70 is more than an adequate replacement: it is an improvement, because it uses pin jacks—doing away with laborious "threading" of leads through the tone-arm.

ALL PURPOSE SINGLE NEEDLE CARTRIDGE FOR 33⅓, 45, 78 RPM RECORDS

MODEL NO.	TYPE	LIST PRICE	OUTPUT LEVEL	MIN. NEEDLE FORCE	RESPONSE TO	NET WT.	SHURE NEEDLE NO.
W70	Crystal	4.95	3.0V 3.8V	10-15 grams	5,000 c.p.s.	16 grams	None

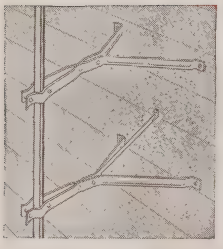
SHURE *The Mark of Quality*

BANISH CORROSION!

END RUST STREAKING CAUSED BY INFERIOR SUBSTITUTES!

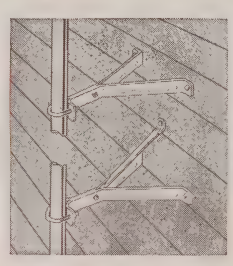
USE A SOUTH RIVER HOT-DIP GALVANIZED PRODUCT FOR AN EVERLASTING RUST-PROOF FINISH

Only SOUTH RIVER gives you such a wide variety of *rust-proof* Hot-Dip Galvanized antenna mountings and accessories



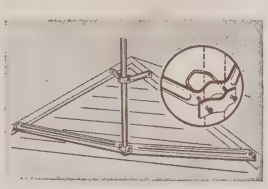
12" WALL BRACKET
(Snap-In Type)
Model SN-12

Features snap-in type mast holder permitting the mast to be held temporarily while screws are tightened. Hot-dip galvanized steel to prevent corrosion and rust-streaking. With hardware. Available in 6", 12", 15", 18" and 24" sizes.



12" WALL BRACKET
Model WB-12

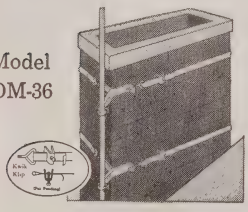
Constructed of heavy-gauge embossed steel, hot-dip galvanized for an everlasting rust-proof finish. Complete with installation hardware. Available in 6", 12", 15", 18" and 24" sizes.



EAVE MOUNT Model EM-48

Heavy-gauge embossed steel lower bracket with generous 48" spread permits secure, rugged installation of mast on homes with varied pitched roofs. Embossed 3" steel upper bracket permits ample clearance of roof edging. Hot-dip galvanized to prevent corrosion and for lasting rust-proof finish. Accommodates masts up to 1½" O.D. Complete with lag screws and mounting hardware. Also available with 60" lower bracket . . . EM-60.

Model DM-36



DUO-MOUNT ANTENNA BASE*

Two piece mount of alloy steel rivet construction, finished in an everlasting, hot-dip, galvanized finish. Specially designed "U" bolts accommodate masts from ⅝—1½" O.D. Exclusive "KWIK-KLIP" feature provides convenient means of fastening loose end of banding. Only South River has this SIMPLE, QUICK strap-fastening device. Also available with stainless steel banding (DM-36 ST); without "KWIK-KLIP" (DM-LKK); with stainless steel banding less "KWIK-KLIP" (DM-LKK ST). **Snap-in type chimney mount also available . . . Model SN-50.**

*U. S. Patent No. 2482575
Can. Pat. No. 463261

Here are many more Hot-Dip Galvanized SOUTH RIVER Products. A Complete Line is Available to Suit Your Individual Needs.

- Steel Tubing, Hot-Dip Galvanized INSIDE and OUTSIDE
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- Chimney Mount Antenna Bases*
- Thrift Mounts
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- Ground Rods
- Large Mast Adapters
- Extension Adapters
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- Wall Brackets

Write for your copy of South River's complete 1954 catalog.

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METAL PRODUCTS CO., INC.
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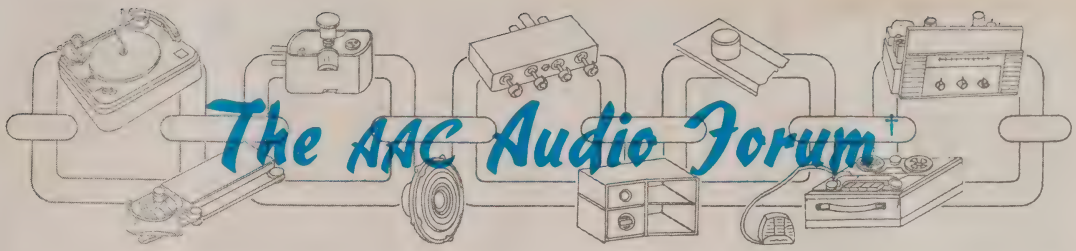
In Canada—A.T.R. Armstrong Ltd., Toronto

PIONEER AND OUTSTANDING PRODUCER OF THE FINEST LINE OF ANTENNA MOUNTINGS

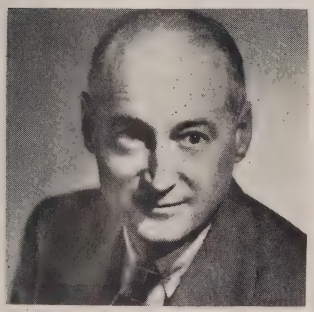


The AAC Audio Forum†

Part III of a Series of System-Component Evaluation and Progress Reports‡

Modern Hi-Fi Amplifier Design Concepts

by Robert Newcomb*



IN FEW FIELDS of endeavor is it more true than in *hi-fi* amplifier design that there is no *one* way to good results. For one to place undue value on a circuit developed by a fine engineer many years ago is to deny himself the fruits of all the engineering effort in the intervening years. While it is true there is little that is really new in basic audio circuitry, it is certainly not true that no improvements have since resulted from all the work done by engineers in recent years. Improved components have permitted new approaches to old problems or have made it possible for simpler circuits to outperform earlier more complex systems. Time has permitted more engineering concentration on the improvement of the whole to the end. Thus, really modern amplifier circuit design cannot truly bear the name of any one early engineer and be truly modern.

Good engineers can produce good results in many different ways. There is no *one* circuit which, above all others, holds the key to all the magic of *hi-fi*. There is no one tube type which can honestly be claimed to provide all of the advantages or be the only type capable of producing *hi-fi*. Any one of many avenues of approach can be used and can be made to produce splendid results, *if* the engineer goes *all* the way to solve all the problems peculiar to his design in its application to the whole.

We, in our lab, have striven for the utmost refinement of the simplest approach wherever possible. The engineer must never allow himself to be carried away by seemingly exciting developments in one special phase of the problem unless, and until, it can contribute to the betterment of the whole. Circuits are constantly developed that achieve certain advantages when considered by themselves, but may place such demands and restrictions on the rest of the circuitry that more may be lost than gained through their use. Distortion is not produced by output tubes alone, as is so often thought to be the case by the layman. Any element of the circuit can and does produce distortion. The best circuit is a well-balanced one which achieves overall perfection in the simplest, most direct, manner. It gets its results from the fine teamwork of all its elements of design and utilizes to the utmost modern component improvements, wherever they can contribute to performance or permit greater simplification, or are more dependable. Even a slight change in the design of one basic element of the circuit can often change the requirements placed on other circuit elements to such an extent that the advantages of the original circuit elements are lost. A slight change can often produce a chain reaction so great that all may have to be replaced by different circuit elements. Modern design recognizes a basic truth . . . *no circuit element can be considered best by itself, but only when considered in the light of the whole.*

A complete modern circuit contains an amazing number of individual circuit elements. Each must perform its function, while at the same time contributing to the ability of its companion circuit elements to function to best advantage. In other words, all of the many elements of a complete circuit are interrelated and are greatly dependent upon each other. Thus, the performance of a given element of circuit design varies with application and associated circuitry and is not always good or bad. It is the practical design engineer who must take these elements and combine them for best results. It is his experience which permits him to recognize the advantages of given circuit elements when used in his current application, yet, when used in another circuit perhaps only slightly different, might not be the best choice.

Thus, the oldest concerns with the most experienced engineering staffs seldom identify their circuits as the work of some one famous predecessor. We all use some portions of the work of early engineers, but the changing requirements of the times and improved materials have made different combinations of circuit elements inevitable. Sometimes circuits which fell into disuse or were considered inferior in early years have become superior in new applications or as a result of the development of new materials and vice versa.

Today, there are available amplifiers of such highly perfected cir-

(*Continued on page 42*)

Newcomb Audio Products Company.

† Presented as a service to industry, in cooperation with the Audio Activities Committee (through its Promotion and Public Relations Subcommittee) of the Sales Managers' Club, Eastern Division, who have arranged for members of the audio industry to contribute authoritative data on all phases of audio in which they are most expert. Comprehensive articles wil contain technical and merchandising information on amplifiers, preamps, speaker enclosures, speakers, turntables, record changers, cartridges, needles, arms and accessories, recording discs and tapes and accessories, tape recorders, special output transformer kits and tuners.

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Audio Forum

(*Continued from page* 41)

cuitry that one can and should now give equal or greater consideration to other factors such as: How does it sound? How well does it fit a need? Is it easy to install? Do the controls accomplish their purpose? Does the manufacturer have a time proven reputation for careful manufacture and rigid quality control? Can its low distortion be easily maintained? Does it carry the U/L label for assurance of absolute safety? etc.

One should realize that when he buys the product of a long established firm with a reputation to maintain, that product contains the results of years of accumulated engineering and manufacturing know-how that cannot be measured in dollars and cents. Such priceless experience goes far beyond the visible features of the product. It extends so deeply into the unseen phases of the product's design and construction that it would be impossible to recognize every one on sight. Therefore, the buyer is urged, in all fairness to himself, to give status to those intangible factors when comparing products and product prices. The sense of security and pride of ownership of a fine product that will serve for many, many years easily warrants the occasionally higher price of such a product. It's not the price alone which counts most, but the value. Extra value lies in the many unseen costs assumed by a manufacturer which, over the years, actually accounts for his reputation.

The Equalizer-Preamplifier Or Control Unit

by Victor H. Pomper*

THE IMPORTANCE of the equalizer-preamplifier in an audio system, unfortunately, is not fully appreciated by most people. There are a great many factors involved in the design and production of these units; their construction does not revolve about any *trick* circuit, as many have been led to believe.

Let us examine what control features are important and why.

The equalizer-preamp must have adequate flexibility to compensate for many conditions determined by external equipment. Personal preferences of individual listeners, room acoustics, speaker response, speaker enclosure characteristics, pickup responses and records (both recording curves and surface condition) all differ. The good equalizer-preamp must allow the sound to be adjusted so that *best listening* is obtained at the listener's ear which, incidentally, also varies. Furthermore, the control unit must compensate and correct for undesirable factors in listening, such as turntable rumble and record surface noise. To use an analogy, a sound system without a good control unit is like a fine, powerful automobile without springs and steered by ropes tied to a front axle.

A good control unit should have the following features: An equalizer with sufficient curves to compensate for the recording characteristics of commonly-used records; treble and bass tone controls with both boost and attenuation characteristics to adjust the frequency response; an automatic loudness control which progressively boosts treble and bass response as the volume is turned lower (compensating for the human ear's insensitivity to treble and bass at low volume); some means for removing such loudness compensation for recording, or similar purposes; a means of minimizing turntable rumble and record surface noise (such as a dynamic noise suppressor, which does not lose audible music as with non-

(*Continued on page* 44)

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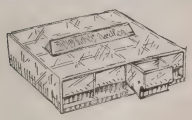


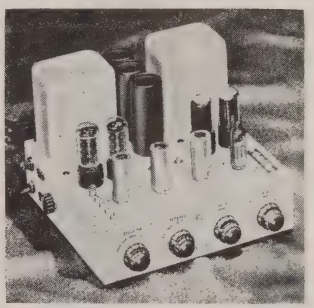
When a conductor achieves fame he knows the score. Generally has it before him for easy reference. You'll always know the score too, in your complicated needle business with this remarkable file cabinet designed of Lucite for quick-glimpse use. Divided sliding drawers (needle package will not fall down). Each needle filed in numerical rotation starting at 501, as easy to see as notes on a score, in standard thickness package—protecting needle with its bubble-blistered window. New package has testing area for needles and detachable label for reordering. One New York dealer reports a 400% increase in sales in 30 days. Cabinet with cross-inventory catalogue system yours free with order of standard assortment kit No. 150 (your cost, $75.00) or needles of your own selection totaling $150.00 retail value. Contact local distributor or Duotone Company, Inc., Keyport, N. J.

Latest in Audio

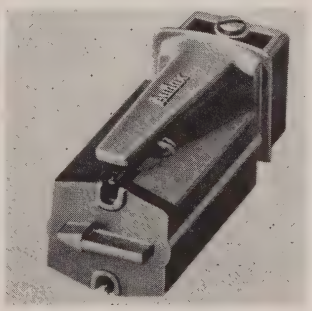
Cartridge replacement kit which contains three crystal cartridges said to replace 192 of the most popular replacement cartridges: a 3-speed, 2-needle unit; all-purpose single-needle unit, and 78 rpm, dual-volt, dual weight unit. Technical data and replacement chart folder is enclosed with each replacement kit; folder provides technical information and a complete replacement chart for the 192 crystal cartridges which can be replaced by basic cartridges. (RK-54 Replacement Kit with W22AB, W26B, W78 cartridges; Shure Brothers, Inc., 225 West Huron St., Chicago 10, Ill.)

(Right)

Magnetic reproducer, said to override magnetic interference (from certain types of motors, etc.). Plays all discs. Either stylus claimed to be replaceable, independently of the other. Response said to be 20-15,000 cps. Designed to feed into resistive load of approximately 100,000 ohms. Supplied with microgroove diamond and sapphire for standard discs. (Model Hi-Q7; Audak Co., 500 Fifth Ave., New York 36, N. Y.)



A 20-watt amplifier employing a circuit said to remove all dc from the output transformer; provide unity coupling between tubes; and eliminate switching transients. Claimed to have less than one-quarter plate-circuit impedance found in conventional amplifier outputs. Also features a damping factor control which is said to permit perfect match of amplifier output impedance to the critical damping resistance of loudspeaker, as well as type of enclosure; operates optimumly into variable impedance of a speaker load rather than a purely resistive load. (Model A20C Circlotron Amplifier; Electro-Voice, Inc., Buchanan, Mich.)



(Left, above)

One-foot long cable assembly developed to adapt miniature 2-input audio mixer (Model 310 Mini-Mix) **for use when panel jack is recessed. Assembly is made of 2-conductor shielded cable (single conductor and a shield).** (Model 8266; Switchcraft, Inc., 1328 N. Halsted St., Chicago 22, Ill.)

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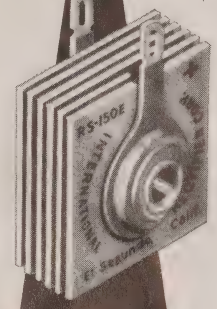

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Audio Forum

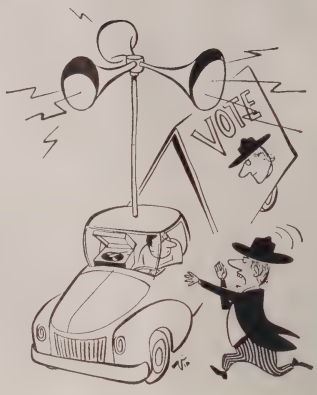
(*Continued from page 42*)

dynamic filters); an input level adjustment for proper operation of the loudness control and devices such as dynamic noise suppressors; a low frequency cutoff filter, and a rolled-off high-frequency response above the upper limits of audibility.

If the frequency response is not cut off sharply below the lower limit of audibility at about 20 cps, the amplifier may respond to sub-audible signals caused by record eccentricity. Since these signals can be very large in amplitude, they may cause the amplifier to operate in an almost continuous state of overload with consequent distortion of music, unless some means is provided for cutting off this unnecessary low response. The high-frequency response should be rolled off at 6 db per octave above the upper limit of audibility (about 20,000 cps), in accordance with professional broadcast standards. If this is not done, inescapable stray coupling between input and output connections may cause ultrasonic oscillation at high frequency. This, while in itself not audible, can cause audible distortion products in the audio range.

The major part of the ultimate success or failure of a sound system is determined by the equalizer-preamplifier. Unfortunately, since the critical low-level inputs are connected to this unit, a large part of the troubles encountered in sound systems will be found in, or associated with, this sensitive units. Typical troubles are, first and most important, tubes which become microphonic or develop hum (particularly the first or preamplifier tube). Such tube failure is not normally detectable by a tube checker, and can be found only by replacing the tubes one at a time with tubes known to be good. Another trouble, often incorrectly blamed on the preamplifier, is the distortion caused by a worn stylus in the pickup cartridge. This is particularly likely if a sapphire is used, so diamond styli are normally recommended. Another common trouble source is improper shielding and grounding of input connections to eliminate hum pickup. Still another difficulty sometimes encountered is acoustic feedback. This is actually a shaking of the pickup cartridge by acoutsic energy from the loudspeaker, with reamplifying of this undesired signal until a loud roar results. Although the low-frequency cutoff filter will decrease such acoustic feedback, often the loudspeaker must be separated by a larger distance from the

(*Continued on page 46*)



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JERROLD

Audio Forum

(*Continued from page* 44)

record player and the record player must be very carefully shock-mounted by springs or sponge rubber. Acoustic feedback is the chief reason why sound systems incorporating both loudspeaker and record player in one enclosure cannot be considered truly high-fidelity. In brief, then, careful selection, maintenance and operation of the equalizer-preamplifier, or control unit, will result in the greatest single contribution to superior sound reproduction.

•

Ser-Cuits

(*Continued from page* 30)

12AX7. This provides negative feedback at the maximum position of the volume control to reduce effectively the gain of these stages in the vicinity of the bias frequency (70 kc), and thus keeps the bias signal out of the audio section during recording.

Bass-Boost Circuit

The bass-boost circuit consists of a network which couples the cathode of a 6V6 output stage to the cathode of the 12AX7 driver stage. This configuration provides a positive feedback signal which can be adjusted to 20 db of boost without instability. A 10,000-ohm pot serves as a threshhold control which can be adjusted for variation in tube gain or for greater or less bass boost as desired. A .02-mfd capacitor provides a cutoff of the high frequencies (in the 400-2,000 cps region) so as to shape the frequency response reaching the cathode of the 12AX7. By varying this capacitor from .005 to .1, the bass-boost response can be changed over a considerable range.

Bass Preemphasis

This bass-boost circuit is shorted out in the *record* position and a fixed 1,500-ohm resistor is inserted for a constant value of bass preemphasis in *record* position. (This value of bass preemphasis can be varied by using a lower or higher value in place of the 1,500-ohm resistor.)

Treble Preemphasis

Treble pre and post-emphasis is achieved by means of a .47-mfd capacitor and a 5,000-ohm pot in the cathode of the 6V6 circuit .

Service Engineering

(*Continued from page 24*)

was found to provide an output of 10 watts at 5% distortion.

Control

Through the use of a low-impedance microphone, the remote control head may be mounted up to several feet from the main power amplifier, without danger of hum pickup and high-frequency attenuation. This is obviously an important advantage when the complete unit is installed and operated within the confines of a vehicle. The control head itself contains the main power switch, pilot lamp, connectors and volume control. The microphone contains the press-to-talk switch. The main power switch turns on the *A* supply to the heater circuits for stand-by operation, while the press-to-talk switch turns on the *B* circuit. This type of switching saves on battery drain, while providing for instant operation.

Output

The output transformer has a selection of either *4* or *8* ohms secondary impedance, providing for various combinations of speaker connections. For interiors of coaches, a conventional 6″ paper-cone speaker has been provided with a bezel. For outdoor application a reentrant horn was selected. Due to the directional properties of the horn, longer distances can be covered.

The amplifier was designed to operate from either 6 or 12 *v dc*. Current drain during standby operation on the 12-*v* circuit is 1.25 amps and 4 amps during *talk* position. The overall gain of the system measured at 1000 cps is 87 db at 10 watts output.

•

Servicing Helps

(*Continued from page 26*)

ture tube. This usually occurs when the yoke has shorted and melted the insulation. This insulation then flows around the neck of the picture tube and hardens. By disconnecting the yoke wires from the circuit and connecting the horizontal winding in series with a heavy soldering iron, enough heat will be generated in the winding to loosen the yoke and it can easily be removed.

Destaticizing Plastic Masks[2]

Recent models of Stromberg-Carlson receivers have a molded plastic mask. Certain types of plastics used may accumulate a static charge. This causes dirt to adhere on various parts of the mask. Liquid household detergents[3] are effective destaticizers. They can be made up in one to two per cent water solutions costing approximately $.15 per gallon and can be applied, allowed to dry and then polished. This will neutralize effectively the static charge.

[2]Such as *Glim* or *Joy*.

Ballast Resistors

New ballast resistors used in radio and TV receivers as replacements may give off smoke when first used. As this may be objectionable to a customer in the home it is advisable to operate all replacement ballast resistors in the shop from two to five minutes.

6CF6 Replacements

A 6CF6 is used in the first picture *if* amplifier in some of the RCA KCS-88 chassis. In receivers where a 6CB6 is used as the *first picture if amplifier*, a 6CF6 should be used when replacement is required. This replacement pertains to the first picture *if* amplifier only and not to the other picture *if* stages.

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Stancor transformers are listed in: Photofact Folders Counterfacts Radio's Master File-O-Matic

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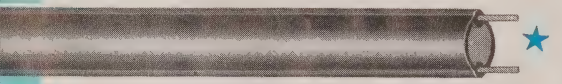

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AMPHENOL

TV Chassis Test Points

(*Continued from page* 17)

line voltage adjusted to 117, with the receiver operating.

(*2*) By the use of a tube test adapter on the power rectifier (or directly where selenium rectifiers are accessible), *B* voltage should then be measured. Tubes or plug-in rectifiers showing an output voltage 10% or more below service-note ratings should be replaced. If the replacement raises the voltage appreciably it should be left in, since the old unit is showing signs of weakness, and if not contributing to the present difficulty can be expected to cause trouble in the near future. Because of the greater difficulty involved in replacing soldered-in rectifiers it is reasonable to attempt to restore satisfactory operation with *B* voltage as much as 20% below service-note ratings. For lower voltages, rectifiers and filter capacitors will certainly have to be checked.

(*3*) With the receiver turned off, and *using due caution,* a short test-lead extension should now be inserted in the picture-tube high-voltage connection, the receiver turned on and the high-voltage measured at both extremes of the brightness-control range (with a high-voltage probe). The maximum value of voltages and the reduction, as the brightness control is turned up, will provide a good measure of the performance of the high-voltage supply and the picture tube.[2] Tubes in the horizontal deflection stages should be replaced to restore normal high voltage. Normal voltage accompanied by a dim raster will indicate a defective or maladjusted ion trap. Less than normal (200 to 400-volt) reduction in high voltage from *min* to *max* brightness indicates low beam current and the possibility of a weak picture tube.

(*4*) Where accessible, *agc* voltage or video-detector output should be measured. This measurement will provide an indication of the operation of the *rf* and *if* portions of the receiver and will give a positive indication of the improvement obtained by replacing tubes in these stages.

(*5*) One should check to see that each channel is within range of fine tuning control.

(*6*) If tuning adjustments and test points are accessible, sound discriminator or ratio detector should be adjusted for maximum output and proper balance. If receiver has a separate sound take-off rather than an intercarrier sound channel, one must be sure that the fine tuning control is properly adjusted before making any sound channel adjustments.

(*7*) Operation of the receiver should be checked at a line voltage of 108 to insure that the raster is filled with reasonable linearity and that the sync is solid on weakest station to be received.

The establishment of procedure of this nature, as routine for all but the very simplest calls, will provide more positive, more effective, and more complete home servicing. Not only will gross failures be corrected, but also the general level of performance will be improved by keeping receivers better adjusted and by weeding out weak tubes before complete failure or horribly degraded performance is encountered. This approach should also lead to a higher degree of customer satisfaction. While the cost of each call would tend to be increased, the number of callbacks should decrease, so that better TV performance would be obtained at less overall cost.

While manufacturers are beginning to include more test points to make in-cabinet testing easier, there is still considerable room for improvement. There are many late model receivers that do not include above-chassis test points. Manufacturers of these models have pointed out that these check points are not being included because they are not generally utilized by service personnel. It is probably true

[2]Geist, J. C., *Picture Tube Faults, Checks and Cures,* SERVICE; May, '53.

that little use is being made of test points during in-the-home servicing. This situation can be attributed to a general lack of information on techniques for their effective use, and because these test points which have been provided are spread over the chassis and are not conveniently accessible from the rear of the cabinet.

Use of a Test Receptacle

It would seem completely feasible to include a test receptacle on the rear apron of a TV receiver chassis to which the key test points in the receiver could be connected. The following test connections could be made to an octal socket: (*1*) *B* voltage; (*2*) boosted *B* voltage; (*3*) *agc* or video detector output; (*4*) sound *if* limiter grid current or ratio detector stabilizing voltage; (*5*) discriminator or ratio detector balance, and (*6*) ground.

Some of these leads would, of course, have to be shielded or isolated. However, the convenience afforded would certainly be worth the slight additional expense. This arrangement would allow the use of a simple plug-in meter-and-switch test unit similar to that used in mobile comm equipment.

With the addition of above-chassis sound-detector adjustments and an accessible contact for high-voltage measurement, a really effective in-the-home service procedure could be based on the use of a plug-in multimeter and a high-voltage probe. It would seem completely reasonable for all manufacturers to standardize on the test-plug connection, so that a single test unit could be used for any make receiver. Since the majority of TV receivers are being maintained by independent service shop organizations, test point technique and equipment standardization would be mutually beneficial to the manufacturer, the service industry and the consumer.

This type of standardization certainly merits the consideration of all service and manufacturers' associations.

While it is true that many thousands of receivers without these features will have to be serviced, industry should find the means of making TV service more acceptable to the public. The foregoing features would be a significant aid in this direction. Furthermore, it is predicted that these or similar service features will be an absolute necessity in color models, to bring the maintenance cost within the economic means of the nation's family of TV enthusiasts; this will be necessary to make color TV a success.

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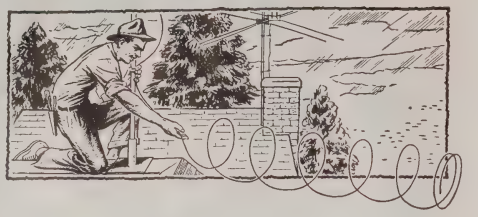

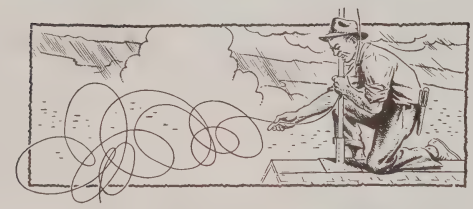

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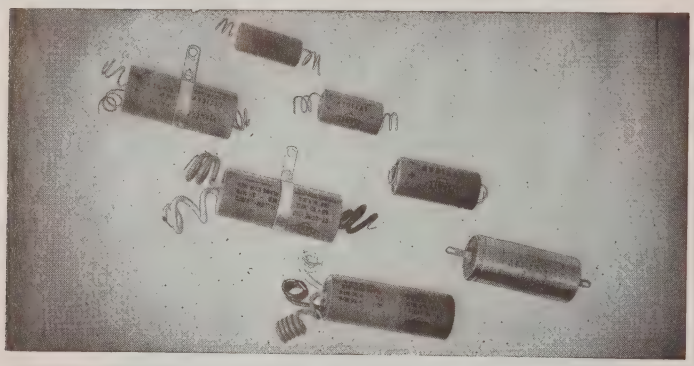

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Color TV Circuits

(*Continued from pages* 18-19)

tions of electrical theory, and in so doing generates a sine wave.

Next, let us consider what happens to the I vector when we have modulation. Amplitude modulation of a sine-wave voltage is conveniently represented by a pair of sideband vectors, as illustrated in Fig. 4. Shown first is the carrier vector I_c, with its two sideband vectors I_{s1} and I_{s2}; the two sideband vectors are initially in phase, as noted, and hence they add directly, or arithmetically, to provide a maximum resultant. Secondly, let us consider this same situation a moment later, when I_{s1} has rotated 45° counterclockwise, and I_{s2} has rotated 45° clockwise, as shown in Fig. 4. Now the resultant of the two sideband voltages is not the arithmetic sum of I_{s1} and I_{s2}, but is the diagonal of the parallelogram I_R. It is clear that I_c plus I_R is less than I_c plus I_{s1} plus I_{s2}. This is the first step in AM.

In Fig. 5, we see that the two sideband vectors I_{s1} and I_{s2} have rotated 90° from their initial positions, and their resultant is zero, so that the voltage of the modulated wave is now equal to the voltage of the carrier I_c. Now in Fig. 6 we have the situation when the two sideband vector voltages have rotated 135° from their initial positions, and their resultant now subtracts from the voltage of I_c. The vectors proceed to rotate further, as shown in Fig. 7, and are now 180° from their initial positions, with the resultant subtracting arithmetically from the voltage of I_c; the result of this subtraction is an instantaneous voltage of zero, as shown. This is the trough of the modulation.

The process then repeats itself cyclically, as the two sideband vectors continue to rotate. As viewed on a 'scope screen, the modulated wave appears as shown in Fig. 8.

Now, let us note an extremely important point, which defines the entire process of synchronous demodulation; *Fig. 4 represents the relative positions of the upper and lower sidebands with respect to the carrier for the case of AM modulation. In amplitude modulation, the carrier voltage and the two sideband voltages all reach their peak voltage at the same instant.*

If we proceed now to Fig. 9, we see the relative positions of the upper and lower sidebands with respect to the carrier for the case of FM modulation. *In the case of graphical representation of FM, the two sideband voltages are initially in quadrature with the carrier voltage, as shown in Fig. 9.* In

(*Continued on page* 52)

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Color TV Circuits

(*Continued from page* 50)

this initial relationship, the resultant is very different from that shown in Fig. 4*A*; the resultant I_R is only a little longer than the carrier I_c (an incidental result of this relationship of the vectors is that I_R has a much different phase, actually a 45° phase difference at this instant of time). Because I_R is not quite equal to I_c, we must refer to the situation as quasi-FM rather than true FM. Although I_c has been shifted in phase, as is required to generate an FM wave, it is seen that a little residual AM is also produced.

At the next moment, I_{s1} and I_{s2} have rotated 45° from their initial positions, as shown in Fig. 10; comparing this situation with that shown in Fig. 4*B* shows that again, an essential FM modulation is occurring in Fig. 10, rather than AM modulation, as seen in Fig. 4*B*. It will be noted that I_R in Fig. 10 is again only slightly longer than I_c although a considerable phase angle appears between I_R and I_c; this phase angle is somewhat less than the angle seen in Fig. 9, and phase modulation of I_c is evidently occurring.

Fig. 11 shows the next step in the modulation, in which the two sideband vectors have rotated 90° from their initial positions, and now oppose each other and momentarily cancel out. The resultant of the three vectors is seen now to be equal to I_c, and the phase angle observed in Fig. 10 has closed to zero. The process will then be repeated cyclically as the sideband vectors continue to rotate, and the phase angle will open to the right in the next step, with the length of I_c changing only a little. This is the process of phase modulation, or FM modulation, as represented vectorially.

It should be noted that the difference between phase modulation and frequency modulation is basically nil. The phase or frequency modulation of I_c which has been followed in Figs. 9 through 11 should be regarded as quasi-FM, because it is evident that in this very simple modulating process, there is a little residual AM taking place.

Now, having reviewed the fundamentals of vector composition, let us have another look at the synchronous demodulator circuit shown in Fig. 1. The following basic electrical principles have been established:

(*1*)—A sine-wave voltage is conveniently represented as a simple vector.

(*2*)—Amplitude modulation of a sine-wave voltage results in progres-

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sive lengthening and shortening of the vector (carrier vector).

(3)—The process of amplitude modulation is characterized by the appearance of two new vectors: the upper sideband vector, and the lower sideband vector.

(4)—The upper sideband vector rotates in an opposite direction from the lower sideband vector.

(5)—The foregoing process describes amplitude modulation when all three vectors start rotating in phase with one another initially.

(6)—The foregoing process describes quasi-frequency modulation when the two sideband vectors start rotating in phase with each other, but in quadrature with the carrier vector initially.

The color signal at the TV transmitter starts with two carrier voltages I_c and Q_c, as depicted in Fig. 12. I_c and Q_c have the same frequency, viz., 3.58 mc, but they are always in quadrature with each other. In other words, the only difference between the two color subcarriers is the 90° phase angle between them. It is on the basis of this phase angle difference that the synchronous demodulator shown in Fig. 1 will accept the I signal, and reject the Q signal.

When I_c and Q_c are both amplitude modulated, as in the normal transmission of color pictures, each vector acquires an additional pair of sideband vectors, as shown in Fig. 13. This is the fundamental process of amplitude modulation, which has been discussed.

In the next step of transmission, the carriers are suppressed and the sidebands are passed, as illustrated in Fig. 14. This is the color signal which is impressed upon the receiving antenna, and this is the color signal which arrives at the control grid of the synchronous demodulator tube.

The two carriers are missing, having been suppressed at the transmitter; however, *one* of the missing carriers is now supplied at the suppressor grid of the synchronous demodulator. The supplied carrier is not only of the correct frequency (3.58 mc), but it is also of the correct phase to produce amplitude modulation when added to I_{s1} and I_{s2}, as shown in Fig. 15. This supplied carrier is also of the correct phase to produce quasi-FM when added to Q_{s1} and Q_{s2}.

The video amplifiers are AM-utilization circuits and do not respond to FM. Hence the I modulation appears as a voltage change in the video circuits, and affects the grid of the picture tube, but the quasi-FM modulation appears as a practically-constant voltage in the video circuits, and does not affect the grid of the picture tube.

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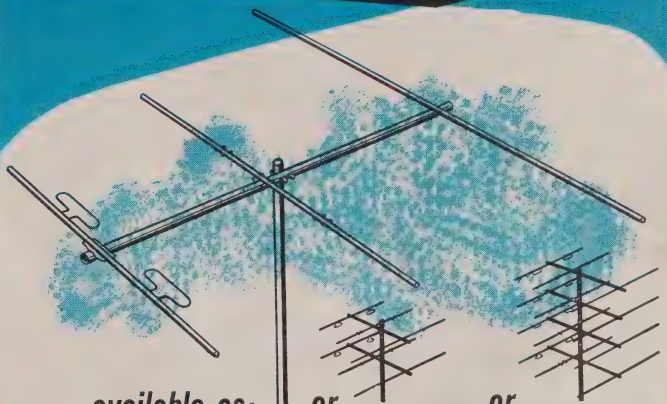

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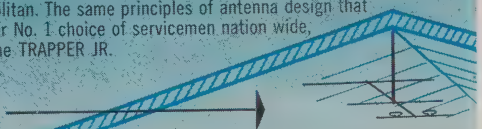

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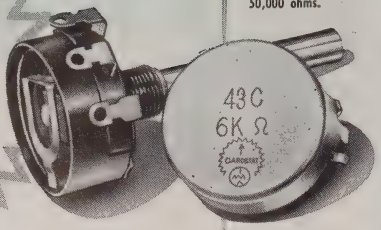

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TV Antenna Digest

(*Continued from page* 20)

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An investigation of the antennas made indicated that it would be necessary to follow a new approach to solve the problem. For instance, the *Trapper* met all the requirements except the first one. This model had substantial gain on the high band, but not quite enough gain on the low band.

After the sales-engineering meeting, the key people of the engineering department met to discuss this problem. The purpose of this meeting was to outline a definite plan so that the electrical and mechanical development of the antenna could progress together. Experience in research and design of antennas has accented the fact that mechanical considerations of an antenna must follow closely on the heels of the electrical configuration. It would be disastrous if the research group completed work on a project before the mechanical designers were consulted.

It was decided, at this engineering conference, that the antenna engineer in charge of this particular project would be *Jack Thomas,* and his test group under *Wayne Hazen* would do development work. *Robert Leitner* received the mechanical design job.

Thomas spent several days reviewing similar antennas and outlining the research program for the development test group. The model shop was then asked to make up a rough model of a five element *twin-driven* yagi with all adjustable elements. Previously broadbanding an antenna of this type had resulted in excellent results, except that the impedance characteristics and the configuration were not satisfactory. In the development of any new antenna, a designer might go up many blind alleys before he finally arrives at the solution; often one runs into new twists not being sought in the immediate problem, but which become useful in the future.

It has been found that most of the research on antenna arrays is experimental, and there is a very definite reason for this condition. It is not difficult to design a yagi which has a good single lobe pattern, but there is a problem in developing impedance characteristics in the order of 300 ohms. This is so because of the unusual characteristics of the yagi. With this type of antenna all the energy is delivered first to the driven element of the array, which could be a two diameter dipole. Part of the energy

is radiated to the distant receiving antenna, but most of the energy is transferred by mutual coupling (or transformer action) to the nine other working elements of the array. This process of transferring the energy is complicated, because each element is accepting energy from, and transferring energy to its neighbors, and still has some energy left over, which it radiates to the distant receiving antenna. To get maximum gain, the radiation from each element should be the same, and the same current maximum should occur in each element. The phase relationship of the current must be such that the elements are working together, like a team of horses, in the direction of maximum signal. As an analogy, let us suppose that one stone was dropped in a calm pool of water; concentric waves of water would travel from the splash. If two stones were dropped, say a foot apart in this calm pool of water, the waves would start crossing each other and interfering, etc. It would be possible to predict the waves' behavior, if the two stones were dropped simultaneously, but imagine the problem that would obtain if ten stones were dropped in a small area and not all at the same time. In the case of the stones, it is easier to make the physical test and record the results, than to make the mathematical computation. In the design of antenna arrays, development work must be done with full size models, with adjustable elements.

To evaluate the antenna, the antenna was installed on one end of a crossarm and on the other end of the crossarm was located a reference half-wave dipole. By rotating the center shaft, it was possible to place the reference dipole in the exact same position as the antenna under test. Instead of using signals from TV stations, which vary constantly as the picture content is changed, a signal was generated and adjusted to several channels. In this way, it was possible to measure the gain at as many as 10 or 15 positions in the channel. This type of measurement is very essential, especially since the arrival of color TV. If the faithfulness of the color is to be maintained, the variation in gain throughout the channel must be kept under 2 db.

The development program in the test field is a lengthy one, since each change or modification of the antenna requires a complete evaluation of all TV channels, *2* through *13*. As a result it often takes several months of constant work to insure a new design.

It was noted earlier that the first requirement to be met in this developmental program was a gain of *7* to 8 db for channels *2* through *6* and a gain of 5 to *7* db on the high band for a single-bay unit. We know from theoretical considerations that to obtain *7* or 8 db on channels *2* through *6* we must have five working elements, approximately a half-wavelength long or their equivalent. Initially, therefore, a five-element twin-driven antenna served as a base, because it was felt that this approach offered a means of covering channels *2* through *6* using the *twin-driven* principle. Several weeks were spent using an adjustable antenna with limited success. Unfortunately the impedance of the array was too low and it was not possible to improve the standing-wave-ratio without a serious loss in gain. It was found though that by using a 600-ohm dipole for the rear element, it was possible to bring up the impedance to a usable value without any loss in gain. At this point engineering was satisfied with the low-band antenna, but it was found that high-band performance was not satisfactory, because a 3-lobe pattern obtained throughout most of the high-band channels. It was known

(*Continued on page* 56)

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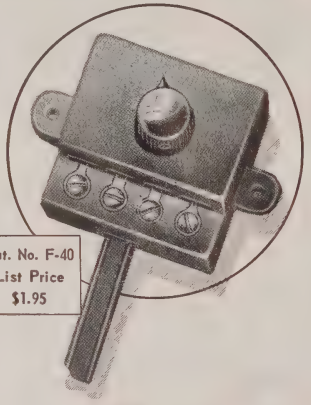

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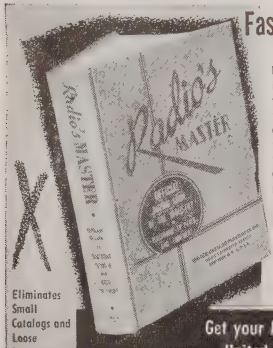

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(*Continued from page 55*)

that this would cause trouble for color reception. In the first attempt to improve the high-band, whiskers were installed about midway in the elements, so that the antenna elements were effectively a half-wavelength for the high-band. This reduced the gain so seriously on the high-band channels that it was not possible to justify this compromise. Next, half-wave reversing stubs were tried, but this affected the low-band impedance to the point where it was not possible to maintain 7-db gain for the low-band channels. There also appeared serious mechanical problems regarding the mounting of these quarter-wave stubs.

As is usually the case, a simple solution, which solved all of the electrical problems, was eventually found. By bending all elements forward 25°, it was found possible to produce a single-lobe pattern throughout the whole high-band, and achieve gains even higher than the original requirements for channels *7* through *13*. The operation on the low-band channel was found to be effected less than *2* per cent.

During this development program, which extended over a two months period, the mechanical engineers had been concerned with the many and unusual contraptions that the electrical group were trying on this antenna. When the idea of the bent forward elements was discussed, the mechanical problem was substantially simplified. A detail of the bracket design and dipole construction developed for this purpose is shown in Fig. 5 (p. 20); tightening of one wing nut secures both elements in place at the same time. The small tabs, bent down from the dipole ends, provide a lock so that the elements cannot move in either direction.

Mechanical Tests

The final mechanical design of the antenna* was evaluated on a vibration table. (This type of test is also used for military antennas.‡ A five minute test at the resonant frequency of the antenna is considered by the military as a life test.) The mechanical design and the tensile strength of the aluminum determine the ruggedness of the structure. For this antenna, an aluminum alloy (52SH-36) with an endurance limit of 18,500 pounds per square inch, was selected. Conventional type of aluminum (3SH-16) has an endurance limit of 9500 pounds per square inch.

---

*Shark.

‡In accordance with Military Specification MIL-T-5422.

NEWS

G-C AND TELCO EXPAND

Plant facilities of the General Cement Manufacturing Co. and Television Hardware Manufacturing Co., Rockford, Ill., have been expanded, with the addition of 10,000 square feet to plant *1*, and 25,000 square feet to plant *2*.

* * *

B-T OPENS SECOND PLANT

A second plant providing over 50,000 square feet of produciton space has been opened by Blonder-Tongue Laboratories, Inc., 526 North Ave., Westfield, N. J.

Supplementing remodeled assembly lines are a machine shop, enlarged service department and shipping and receiving facilities. Heading factory operations are production manager *Arthur Janus* and his assistant *Robert Hamer*.

* * *

RCP MULTITESTER DISPLAY

A point-of-sale 4-color display has been created for the *480* universal multitester, by Radio City Products Co., Easton, Pa.

* * *

VIDAIRE INCORPORATES

Vidaire Electronics Manufacturing Co. has been incorporated under the name of Vidaire Electronics Manufacturing Corp. Corporation will retain the same management and personnel, and will continue to produce TV components.

* * *

JFD AD DRIVE

James C. Sarayiotes, president of Delphi, Inc., 1620-61st St., Brooklyn, N. Y., ad agency, has announced plans for an extensive campaign to promote JFD's *Jet-Helix*, *Shut-Out* and *Super-Jet* antennas, *Roto-King* rotator, and TV accessories.

Program, it is said, will be spearheaded by ads appearing in 15 national magazines, and in daily, Sunday, and weekly newspapers across the country. Direct mail, cooperative advertising, radio and television commercials, window streamers, counter displays, and brochures will also be used.

* * *

SYLVANIA APPOINTS J. WALTER THOMPSON AS AD AGENCY

J. Walter Thompson Co., has been named ad agency, effective November 3, for Sylvania Electric Products Inc.

J. Walter Thompson will replace Cecil and Presbrey Inc., and Roy S. Durstine Inc., and will be engaged in product advertising and merchandising projects of a company-wide and divisional nature.

* * *

JULIAN K. SPRAGUE NOW DEFENSE ADVISORY GROUP HEAD

Julian K. Sprague, president of Sprague Electric Co., North Adams, Mass., has been named chairman of the Advisory Group on Electronic Parts of the Department of Defense.

* * *

CBS-HYTRON PIX TUBE PROMOTION

Mirror-back picture tubes are now being promoted widely by CBS-Hytron, Danvers, Mass.

Campaign explains benefits of aluminized tubes.

Program is supported by promotion kit for Service Men, kit consisting of a *22"* by *28"* advertised-in window poster, 25 consumer self-mailers, and an identifying *Certified Quality Service* decal.

ROHN *the Foremost Name in TV Towers...*

PRESENTS

2 new additions

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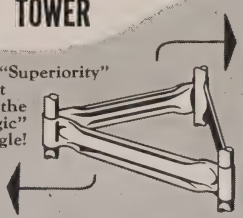
The "Superiority" secret is in the "magic" triangle!



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WALSCO EYE LEVEL DISPLAY

A merchandising display for the *99 Line* of hardware and chemicals has been introduced by Walter J. Schott Co., Los Angeles, Calif.

Display houses entire line at *eye level*. Stock is kept in sliding drawers, covered and free from dust. Each drawer has automatic feeding with individually spring loaded tracks. When one box is removed, the others slide forward automatically. Display is finished in black and gold hammertone. Legs are black wrought-iron. An open shelf is provided at the bottom for displaying chemicals and other Walsco items.

Right: Walsco Display

NEW MULTIMETER KIT
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Rep Talk

SEVEN MEMBERS have joined The Reps recently, increasing the organization's membership to 656. The new members include: Chicagoland . . . *Jay C. Angel,* 800 N. Clark St., Chicago, Ill. (senior); *J. R. Angel* and *Les Angel,* Jay C. Angel Co. (associates); and three additional associates; *John J. Lightner* with C. R. Bluzat, and *Lawrence B. Cole* and *Wallace B. Phillips,* both with George Petitt Co. Los Angeles . . . *LeRoy J. Smith,* 1141 S. La Cienega, Los Angeles 35, Calif. (senior); *Frank B. Koessler,* 6907 Melrose Ave., Los Angeles, promoted from associate to senior membership. . . . *William J. Doyle Co.* has moved to 7002 N. Western Ave., Chicago 45, Ill. . . . *Ray R Hutmacher Associates, Inc.,* are now at 6647 N. Oliphant Ave., Chicago 31. . . . *A. M. Lock,* formerly components test engineer with Raytheon, has joined Magnuson Associates, 4258 W. Irving Park Rd., Chicago. . . . *Barron-Jur Co.,* 817 South Hoover St., Los Angeles 5, Calif., have been named southern California reps for the General Cement Manufacturing Co. and Television Hardware Manufacturing Co. . . . *Jim Dooley,* J. K. Dooley Sales Co., 3606 Magnolia, Seattle, Wash. (Washington and Oregon), and *H. E. Russell Sales Co.,* Iola, Kansas (Kansas, Missouri, Iowa and Nebraska), have been appointed reps for American Screen Products Co. . . . *John J. Nolan,* 314 W. Sparks St., Philadelphia, Pa. (Virginia); *Paul Hayden and Associates,* P. O. Box 331, East Point, Ga. (Florida, Alabama, Georgia, Tennessee, North and South Carolina, and Mississippi); *J. R. Hughes,* 51 Russell Ave., Buffalo, N. Y. (Vermont, Connecticut, and western Massachusetts); and *Ray Ripley,* 4306 N. Tripp Ave., Chicago, Ill., (Minnesota, eastern North and South Dakota, and western Wisconsin), are now reps for The Finney Co. . . . *Arthur K. Elliott Co.,* 8305 Cherokee Lane, Kansas City 13, Mo., has been named rep for Clarostat Manufacturing Co., in Kansas, Nebraska and western Missouri. . . . *Wes Alerson Co.,* 10430 National Blvd., Los Angeles 34, Calif., has become rep for Quam-Nichols Co., in southern California. . . . *C. L. Pugh Co.,* 4500 Dublin Rd., Columbus, O., has been appointed rep in Ohio, western Pennsylvania and West Virginia, for International Rectifier Corp. . . . *A. J. Rissi,* Monrovia, Calif., has become rep for Superex Electronics Corp., and Everlast Wire and Cable Co., in southern California and Arizona. . . . *L. D. Lowery, Inc.,* Philadelphia, Pa., will represent The Astatic Corp., in eastern Pennsylvania, southern New Jersey, Delaware, Maryland, Virginia, and the District of Columbia. . . . *Emory S. Todd* now represents Krylon, Inc., in eastern Pennsylvania, southern New Jersey, Maryland, Delaware, Virginia, and the District of Columbia.

John J. Nolan

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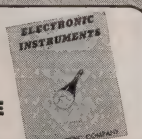

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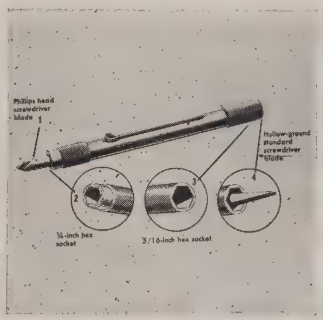
Tools . Parts

HYTRON 4-WAY TOOL

A *4-Way tool* designed to remove back covers of TV receivers, has been announced by CBS-Hytron, Danvers, Mass.

Tool consists of three parts: a slotted steel barrel with hex sockets (¼" at one end, 5/16" at other); a double-ended screwdriver blade (one end with Phillips head, the other end with hollow-ground standard head) which slides inside the barrel; and a knurled setscrew to lock the sliding blade into any one of three recessed positions within the slotted barrel.



CBS-Hytron 4-Way Tool

* * *

XCELITE PORTABLE COLOR-CODED NUT DRIVERS

A nut driver kit, *77*, that contains seven nut drivers, 3/16" through ⅜", each with different colored handle to indicate size, has been introduced by Xcelite, Inc., Orchard Park, N. Y.

Plastic kit snaps shut to 6¼" x 7".

* * *

CENTRALAB REPLACEMENT CONTROL

A replacement control, *Snap-Tite*, that is said to require no tools, mounting nuts or lock-washers, or other hardware to install, has been developed by Centralab, 900 East Keefe Ave., Milwaukee 1, Wis.

Unit is pushed into the chassis mounting hole, and *snaps* itself in place. Control is designed primarily for fine-adjustment controls in TV and electronic equipment, being made with a short ½" knurled and slotted shaft for fingertip or screwdriver adjustment. Shaft is molded from high-impact blue color plastic. Replaces any ½-watt standard bushing mounted or twist-tab type control having one or two locating lugs.

* * *

VOKAR VIBRATOR LINE

A line of *Imperial* 6-12 *v* replacement vibrators are now available from the Vokar Corp., Dexter, Mich.

Vibrator is claimed to feature contact points coated with anti-oxidizing agent; electronic selection of reed and reed-weight combinations to assure frequency accuracy; plated parts to insure rapid heat transmission away from points; and low noise-level.

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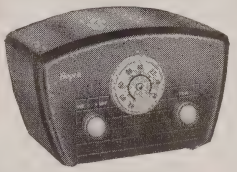
NEW 'UCT-1' UHF CONVERTER



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- 6 db reduction in noise level means corresponding 6 db increase in signal level from antenna—clearer viewing
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- connects to any VHF set
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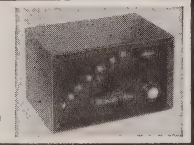
"G-Line," UHF Transmission line, list $43.75 (kit includes: 2 launchers, 150 feet of special insulated wire, 2 standoff brackets)

"UHB," UHF Booster, list $41.00



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25TH ANNIVERSARY CELEBRATION HUDDLE

(Left)

Executives of General Cement and their ad agency, studying plans for G-C's 25th birthday, which occurs on January 6, '55: Duane Rice, art director of Paul J. Steffen Advertising Agency, pointing out detail of anniversary art work to G-C officers, R. G. Ellis **(left) and** S. B. Valiulis **(3rd from left). Holding art is** Paul J. Steffen, **while agency men** William J. Hennig **and** J. A. Angarola **look on.**

CETA (RETMA SCHOOL) OFFICERS MEETING

(Right)

At sixth business meeting of the Certified Electronic Technicians Association, composed of graduates of the advanced TV training course taught under the auspices of RETMA. Left to right: Marty Bettan, **RMS rep, guest speaker;** Sam Roth, **CETA legal advisor; Ernie Schaffer, CETA program director; Clifford Shearer, RMS director of advertising, who was appointed CETA public relations chairman;** Ed Tillin, **CETA secretary;** Bill LaComba, **CETA treasurer and** Fred Saron, **CETA president.**

* * *

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Finest Cleaner for Electrical Parts

1. Quickly removes oil, grease, tar and other soils from electrical parts!
2. Safe. Won't burn! Won't explode!
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4. Dries instantly—no odor or residue!
5. Economical for cleaning sliding contacts, condensor plates and chassis. Also as a wash for carbon deposits.

In gal. cans, qt. cans, 8-oz. bottles. Order from your jobber.

THE KERDEN CHEMICAL CO.
BOX 1076, STATION "A" • CLEVELAND 2, OHIO

HYKON WIRE MEASURER

A wire measurer, for wire, rope and other flexible materials up to 1" in diameter, has been announced by the Hykon Manufacturing Co., 131 E. State St., Alliance, Ohio.

Featuring a meter and take-up reel mounted on a steel frame-work, unit registers up to 1000', and instantly resets to zero. Reel has a tapered cone for easy removal, and outer spokes slip off to facilitate removing the coil. Reel holds up to 1500' of No. 14 wire; other sizes accordingly.

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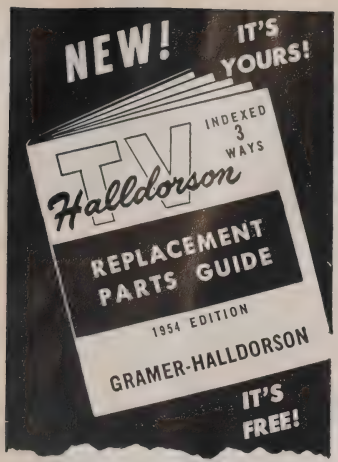
Be sure to notify the Subscription Department of SERVICE at 52 Vanderbilt Avenue, New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.



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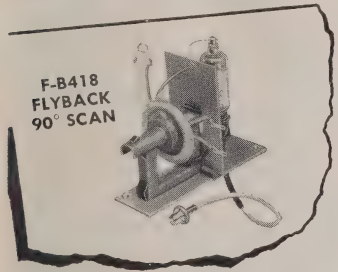

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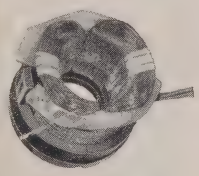

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Instruments

RCA UHF DEMODULATOR

A *uhf* demodulator *WG-298A,* for use as an accessory with *uhf* TV test equipment operating in the 300-950 mc frequency range, has been announced today by the Tube Division, RCA, Harrison, N. J.

A plug-in type, with a built-in germanium diode, demodulator operates between a 50-ohm single-ended source and a balanced 300-ohm transmission line. Provides a terminal for connection to a 'scope for observation and measurement of *vswr* patterns.

* * *

RCP SWEEP GENERATOR

An electronic sweep generator, *780,* designed for color and b-w TV chassis, and FM, AM and communication equipment, has been developed by Radio City Products Co., Inc., Easton, Pa.

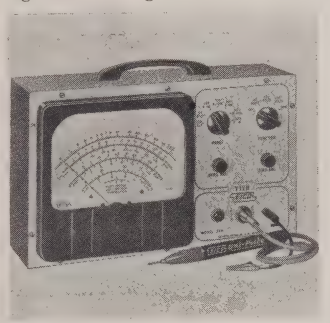
Range is from 3.2 to 900 mc. Incorporates multiple shielding to minimize leakage. Design is said to provide for complete blanking of return trace, and permit a starting point to be set as desired on the calibrated dial. Utilizes *agc* for uniform output level.

* * *

EICO P-P VTVM

A peak-to-peak *vtvm, 249,* in kit or wired form, is now available from the Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y. A dual purpose *ac/dc Uni-Probe* is included.

Featuring a 7½" meter, unit incorporates a push-pull triode bridge circuit that is said to be unaffected by line voltage variation. Ranges include: *dc* voltmeter 0-1.5, 5, 15, 50, 150, 1500 *v* (to 30 kv with *hv* probe); *ac* voltmeter with *rms* reading of sine waves same as *dc;* peak-to-peak reading of sine and complex waves. . . . 0-4, 14, 42, 140, 420, 1400, 4200 *v.* Separate scale for 0-15 *v rms* and corresponding 0-4 *v* p-p ranges. Frequency response: 30 cps to 3 mc (to 250 mc with *rf* probe). Ohmmeter 0-1000 megohms in 7 ranges.



* * *

BOLLAND AND BOYCE HV PROBE

A *hv* probe, for measurements up to 30 or 60 *kv* using a *vtvm,* multimeter, or voltmeter, having 10,000 ohms-per-volt or more, has been introduced by Boland and Boyce, Inc., 236 Washington Ave., Belleville 9, N. J.

Complete with set of plug-in precision resistors to match any meter rated at 10,000 ohms-per-volt or more.

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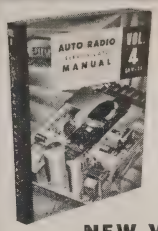

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Vol. 3. Covers 50 amplifiers and 22 tuners made in 1950. 352 pages, 8½ x 11". Order **AA-3.** Only.....**$3.95**

Vol. 2. Covers 104 amplifiers and 12 tuners made in 1949. 368 pages, 8½ x 11". Order **AA-2.** Only.....**$3.95**

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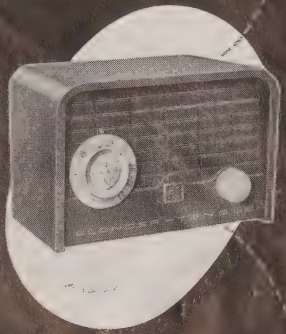

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TV Parts... Accessories

C-B-C PICTURE TUBE BRIGHTENER

A TV picture tube brightener, *UB Picboost,* that is claimed to restore brightness to dim picture tubes in a TV receiver, whether series or parallel wired, is now available from C-B-C Electronics Co., Inc., 1310 Callowhill St., Philadelphia 23, Pa.

Transformer is heavy-duty type, which it is said draws negligible exciting current.

* * *

G-C ILLUMINATED INSPECTION MIRROR

An illuminated TV chassis inspection mirror, *8725,* similar to a dentist's oral inspection mirror, is now available from General Cement Manufacturing Co., 919 Taylor Ave., Rockford, Ill.

Device, 12¼" long, has no external cords or connections. From an anodized aluminum case, two batteries illuminate a bulb which transmits its light along a 6" transparent Lucite rod to a hinge-mounted mirror on the end.

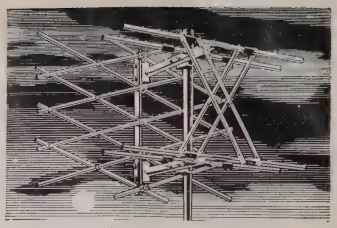
* * *

RAYTRONIC PICTURE TUBE TESTER

A *Cathode Beamer* that, it is said, tests and can remedy common picture-tube faults, has been developed by Raytronic Laboratories, Inc., 9701 Reading Rd., Cincinnati 15, Ohio.

Device tests for filament condition, element continuity by mutual conductance method, shorts, leakage up to 20 megohms, emission, grid cut-off and grid control, cathode test, and gas. Unit is claimed to restore brightness by cathode sweeping, bring up old tubes by grid expansion, burn off low resistance *k-g* shorts or high-resistance interelement shorts, and weld open cathode tabs.

Single socket will fit most TV tubes, with either electrostatic or magnetic focusing. Adapter socket is provided for non-standard types and for use with other types of pix tubes.



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JOTS AND FLASHES

EVIDENCE of the emphasis that TV manufacturers are placing on color service appeared recently in an announcement from CBS-Columbia that they have established a complete color service training school in a 20,000-square-foot building at 4850 34th St., Long Island City, N. Y. Provision has been made for specialized classroom instruction, as well as complete work bench units for practical work by Service Men attending the course. Currently, series is being conducted for selected distributor service personnel. . . . A 6-page illustrated manual, covering the service and repair of printed circuits used in Admiral radio and TV receivers, has been prepared. According to *Max Schinke,* Admiral's national service manager, there are well over 6-million parts in the printed sets released by Admiral and now in use in the field. . . . *Albert A. Pulley,* manager, general recording, RCA Victor Records Division, RCA, N. Y., has been elected president of the Audio Engineering Society, succeeding *Jerry B. Minter,* president of the Components Corp., Danville, N. J. *C. J. LeBel,* chief engineer, Audio Instrument Co., Inc., New York, a founder and first president of the society, was reelected secretary for his fourth consecutive term. . . . A symposium on printed circuits will be held on January 20-21 at the University of Pennsylvania, under the sponsorship of the engineering department of RETMA. Subjects to be covered include: product design applications; reliability and serviceability; technique of producing printed wiring boards; printed components and components for use with printed wiring; and production techniques and manufacturing methods. . . . The sale of DuMont TV picture tubes for replacement in the far western states has shown a 160 per cent increase for the first 6 months of '54 compared to '53, according to *Edwin B. Hinck,* replacement sales manager for the cathode-ray tube division for Allen B. DuMont Labs, Inc. . . . *Bob Middleton,* chief field service engineer for Simpson Electric, is now on tour in the Pacific Northwest, offering color TV service talks and demonstrations. He's covering Billings, Montana; Idaho Falls, Idaho; Spokane, Tacoma, Seattle and Everett, Washington; and Eugene and Portland, Oregon. . . . *Doug Carpenter,* chief antenna engineer for JFD, recently journeyed to Lima, Ohio, and Pittsburgh, Pa., to demonstrate the JFD jet-helix antenna. Carpenter has travelled 87,000 miles in the past year conducting antenna tests and lectures throughout the U. S. and Canada. . . . *S and A Electronics,* manufacturers of *Target* antennas, has moved to 1025 Nevada St., Toledo 5, O. . . . A national newspaper, trade paper and general magazine campaign, promoting *Tenna-Rotor,* antennas, *uhf* boosters, and other TV accessories, has been initiated by Alliance, according to *John Bentia,* executive vice prexy. "Today, more than ever," said Bentia, "there is a constant growing demand for antenna orientation. More new stations, multiple station areas, power increases, transmitter relocations, and higher towers have created a need for antenna rotation."

ADVERTISERS IN SERVICE
OCTOBER, 1954

	Page
Allied Radio Corporation	58
American Phenolic Corp.	48
Argos Products Co., Inc.	2
Astron Corp.	45
Blonder-Tongue Labs.	62, 63
David Bogen Co., Inc.	60
Bussmann Mfg. Co.	5
CBS-Hytron	37
Channel Master Corp.	22, 23
Chemical Electronic Engineering Co.	44
Chicago Standard Transformer Corp.	47
H. G. Cisin	59
Clarostat Mfg. Co., Inc.	54
Cleveland Institute Radio Electronics	54
Cornell-Dubilier Electric Corp.	55
Cornish Wire Co., Inc.	59
Crosley Div. Avco Mfg. Corp.	64
Duotone Co., Inc.	43
The Finney Co.	27
General Cement Mfg. Co.	31
Gramer Halldorson Transformer Corp.	61
The Heath Co.	58
Hycon Mfg. Co.	49
International Rectifier Corp.	44
JFD Mfg. Co., Inc.	10
Jensen Industries, Inc.	44
Jerrold Electronics Corp.	46
Kay Electric Co.	59
Kerden Chemical Co.	60
Kester Solder Co.	46
P. R. Mallory & Co., Inc.	Inside Back Cover
Merit Coil & Transformer Corp.	33
Mosley Electronics, Inc.	56
Moss Electronic Dist. Co., Inc.	51
Ohmite Mfg. Co.	13
Perma-Power Co.	52
Permo, Inc.	42
Philco Corp.	4
Planet Mfg. Corp.	50
Quam-Nichols Co.	30
Quietrole Co.	62
Rad-El-Co. Mfg. Co.	62
The Radiart Corp.	Inside Front Cover
Radio Corporation of America	Back Cover
Radio Receptor Co., Inc.	60
Raytheon Mfg. Co.	14
Rohn Mfg. Co.	57
Howard W. Sams & Co., Inc.	61
Shure Brothers, Inc.	39
Skyline Mfg. Co.	32
South River Metal Products Co., Inc.	40
Standard Coil Products Co., Inc.	6
Superex Electronics Corp.	58
Sylvania Electric Products, Inc.	11
Sarkes Tarzian, Inc.	29
Technical Appliance Corp.	53
Telrex, Inc.	3
Triad Transformer Corp.	12
Triplett Electrical Instrument Co.	1
Tung-Sol Electric, Inc.	8, 9
United Catalog Publishers	56
Vidaire Electronics Mfg. Co.	56
Walco-Electrovox Co., Inc.	42
Weston Electrical Instrument Corp.	34
Winegard Co.	7
Winston Electronics, Inc.	12
G. F. Wright Steel & Wire Co.	50
Z & W Machine Products	52

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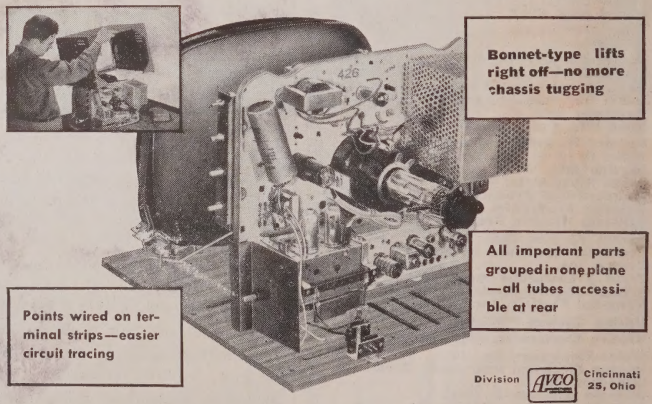
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RCA WO-88A (5") and WO-56A (7") Oscilloscopes	RCA WR-89A Crystal Calibrator	WR-59C Sweep Generator	RCA VoltOhmyst*
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